

4 CHARACTERIZATION REPORT

This section provides the reader with a general characterization of the City of Columbus' wastewater collection system, treatment plants, and receiving waters.

4.1 Wastewater Collection System

This section provides a general description of the key components of the wastewater collection system and how they receive and transport tributary wastewater flows from locations within the sewer facilities boundary.

The City of Columbus, Department of Public Utilities, Division of Sewerage and Drainage (DOSD) operates and maintains an extensive sewer system, which serves 22 municipalities, portions of Franklin County and the City of Columbus. DOSD operates and maintains two wastewater treatment plants (WWTPs), two stormwater storage facilities, and many control structures and devices.

FIGURE 4.1.1 illustrates the following:

- Separate sanitary sewers operated by the City of Columbus, DOSD
- Combined sewer system operated by the City of Columbus, DOSD
- Separate storm sewer system operated by the City of Columbus, DOSD
- Designed sanitary relief (DSR) structures, which are cross connections between the sanitary sewer system and either a water way or a stormwater sewer system
- Permitted combined sewer overflow (CSO) locations
- Facilities Planning Area boundary
- Major satellite municipalities served by the City of Columbus, DOSD

FIGURE 4.1.2 illustrates the following key components of the sewer system:

- Main trunk sewers
- Relief trunk sewers
- Storage facilities
- Pump stations
- Designed sanitary relief (DSR) structures
- Combined sewer overflow (CSO) structures
- Wastewater Treatment Plants (WWTPs)

The collection system is arranged into three parts based on sewer type: separate sanitary sewers, combined sewers, and storm sewers. Both the separate and combined sewers are arranged into sewersheds based on system drainage areas ranging in size from 20 acres to 300 acres. **TABLE 4.1.1** provides a brief description of the tributary areas to the separate and combined sewer system in the Columbus area. **FIGURE 4.1.3** illustrates the identified areas and

tributary sewers 18-inches and larger. **FIGURE 4.1.4** illustrates a schematic of the main trunk sewers and their connectivity and relationship with the WWTPs.

For existing conditions, the combined sewer system, the Olentangy Scioto Interceptor Sewer tributary area, and the Upper Scioto West Interceptor Sewer tributary area are served by the Jackson Pike Wastewater Treatment Plant (JPWWTP). The Interconnecting Sanitary Trunk Sewer tributary area and the Big Walnut Sanitary Sewer Outfall tributary area is served by the Southerly Wastewater Treatment Plant (SWWTP). On the west side, the Interconnecting Sanitary Trunk Sewer serves two purposes, (1) allow for flow diversion and in-system storage for a portion of the sanitary flow from the JPWWTP to the SWWTP and (2) to provide sanitary sewer service to the drainage areas lying between the two WWTPs.

The Columbus Metropolitan Facilities Plan Update, 2000 has identified the service area and facilities boundaries for the central Ohio region. **FIGURE 4.1.5** illustrates major trunk sewers and delineated tributary areas to each trunk sewer. **FIGURE 4.1.5** also shows the Facilities Planning Area Boundary.

4.1.1 Combined Sewer System

The CSO CO defines a combined sewer as *“portions of [the City’s] Sewer System designed to convey both municipal sewage...and stormwater runoff through a single pipe to [the City’s] interceptor sewers, Wastewater Treatment Plants, or a combined Sewer Overflow Outfall, or any area that is tributary to a sewer regulator.”*

The combined sewer system is located in the central portion of the City of Columbus as shown in **FIGURE 4.1.1**. The combined sewer area within the City of Columbus discharges into the following sewers:

- Olentangy Scioto Interceptor Sewer (OSIS)
- North-East Sewer (Main Street Sewer) , which discharges into the Alum Creek Area Trunk Sewer
- South Side Interceptor sewer, which discharges into the OSIS.

During dry weather flow (DWF) no overflows occur since all tributary flows are intercepted by the listed sewers. During wet weather flow (WWF) CSO reliefs intercept portions of the stormwater runoff and allow excess flow to be diverted to storm sewers. Both the OSIS and the North-East Sewer can direct their tributary flow into two storm stand-by facilities to provide partial treatment of the flow before being discharged to the river. The storm facilities are:

- Whittier Street Storm Stand-by Tanks (WSST)
- Alum Creek Storm Tank (ACST)

The WSST should not be confused with the Whittier street regulator and the Whittier Street overflow. The WSST are the physical stormwater storage facilities. The Whittier Street overflow allows flow in excess of the WSST storage capacity to discharge directly the Scioto

River. The Whittier street regulator is a permitted combined sewer structure located a short distance northeast from the WSST.

FIGURE 4.1.6 shows the boundary of the combined sewer system. **FIGURE 4.1.7** illustrates runoff catchments within the combined sewer area. The green area in **FIGURE 4.1.7** delineates the combined sewer system area where all storm runoff is directly tributary to the combined system. The yellow area shown on **FIGURE 4.1.7** indicates the separate sanitary sewer area. **FIGURE 4.1.7** shows the separate sanitary sewer areas that are tributary to the combined sewer system in white. This area is the result of sewer separation projects implemented by the City of Columbus to mitigate the impact of the combined sewer overflows to waterways. The separation includes disconnecting street catch basins but not disconnecting either building downspouts or foundation drains from the separate sanitary system. Therefore, this area is considered a separate sanitary area within the combined sewer area. Due to their current configuration this area still contributes some storm runoff into the combined sewer system.

There are currently 32 permitted CSO locations within the Columbus combined sewer system. Note that other sections of this report list or refer to 30 CSOs in the combined system. The Cozzins Street CSO is scheduled for near-term removal and for most analysis purposes the high level emergency relief at the WSST is considered as part of the WSST overflow. Therefore these two NPDES permit listed overflows are not counted for analysis purposes. **FIGURE 4.1.6** illustrates these locations. **TABLE 4.1.2** lists those CSOs and the corresponding NPDES permit CSO discharge number.

The following paragraphs describe the combined sewer system tributary to main trunk sewers and the two storage facilities.

The first 29 CSOs listed in **TABLE 4.1.2** are tributary to the OSIS. The OSIS is the only contributor to the Whittier Street Storm Tanks (WSST) which intercept tributary flows from the combined sewer system and other separate sanitary sewer systems. The WSST consists of three tanks, each tank having a storage capacity of 1.36 million gallons (MG). The total volume of the entire facility is 4.1 MG. The WSST were designed to provide a rated capacity of 204 million gallons per day (MGD) with a 30-minute detention time when full (Gregory et al, 1933).

FIGURE 4.1.8 illustrates a schematic of the WSST and the surrounding sewer facilities. The WSST facility was upgraded in 1966 to have a solids collection system. The floors were sloped to add drainage of the collected solids. The floor elevations of the WSST are above the invert level of the OSIS by approximately 5.0 feet. Each tank has four square sluice gates (48-inch) as inlets from the OSIS. The invert elevation of each gate is 698.93 feet, which is approximately 7.25 feet above the invert level of the OSIS. The WSST are not covered.

The operation of the WSST is managed by a control unit (control house) which is comprised of the following:

- Two regulator gates; each gate is four feet wide by six feet high to control the flow rate from the OSIS to the Jackson Pike WWTP.

- Three shut-off gates; each gate is four feet wide by six feet high downstream of the regulator gates to control the flow rates into the OSIS from the Franklin Main Interceptor Sewer and the Alum Creek Interceptor Sewer.
- Three emergency outlet gates; each gate is four feet wide by seven feet high to permit the discharge of the OSIS into the Scioto River as a last resort during extremely high flow.
- Two storm overflow gates on the storm overflow channel; each gate is four feet wide by seven feet high to prevent the Scioto River from backing up into the tanks in the case of high river elevation.

For details of the control gates within the WSST control house refer to the Interconnector Sewer System Operations Manual Volume 3 prepared by OCS Inc. May 24, 1989.

DOSD developed an operational plan titled “2003 Interim Interconnector Sewer Operational Plan”. The plan sets a priority list of the operation for both the collection system and the treatment facilities including the WSST. For details of these priorities, refer to the operation report and to **SECTION 4.2.5**.

A detailed description of the permitted CSOs is included in **APPENDIX B**, which includes the following information: record plan number; dimensions of influent and effluent sewer at the CSO regulator location; influent invert elevation; sluice gate size; sluice gate invert elevation; regulating chamber (RC) shape; RC length, width, and depth; critical elevations within the RC, weir information, intercepting pipe information, receiving interceptor sewer information, and overflow channel information.

Tributary sewers to the North-East Sewer located at Main Street are primarily separate sanitary sewers with the exception of approximately 500 acres of combined sewers. The total tributary area to the North-East sewer is approximately 3,000 acres. The combined sewer area is located in three separate parts of the sewershed as illustrated in **FIGURE 4.1.7** and as follows:

- Area 1: Southeast of the I-71/I-670 interchange
- Area 2: Franklin Park Conservatory
- Area 3: East Main Street

The North-East Sewer, also known as the Main Street Sewer, is a 108-inch line that begins at the Alum Creek Storm Tanks and extends upstream to the west along East Main Street. Its maximum capacity is 195 million gallons per day (303 cubic feet per second). The sewer splits at the intersection of East Main and Fairwood Avenue into the 72-inch portion of the North-East sewer, serving the west side of the sewershed.

The Alum Creek Storm Tank is a covered stormwater storage tank that has a capacity of 0.85 MG. There is a channel along the west side of the tank that functions as a continuation of the 108-inch North-East Sewer to transport DWF without entering the tank. The tank is regulated by a 48-inch square regulator gate. The gate is stationary and has a 12-inch opening to allow DWF to pass through the Alum Creek Intercepting Sewer (ACIS) and into the Alum Creek Trunk Sewer. During WWF, if the flow depth in the channel is greater than approximately

twelve inches, the tank becomes active. Once the tank is full, excess flow exits through the ACST overflow conduit into Alum Creek. Further downstream there is a 36-inch overflow “window” in the ACIS that discharges to a 48-inch pipe leading to the Deshler Tunnel.

TABLE 4.1.3 lists general information about the sluice gates that are located within the Columbus sewer system. **TABLE 4.1.4** lists general information about the weir structures that are located within the Columbus sewer system. For more detailed information about sluice gates and weirs, refer to **APPENDIX B**.

4.1.2 Separate Sewer System

The total linear feet of separate sanitary sewers operated by the City of Columbus is approximately 14,114,000 feet (2,673 miles) as per 2004 conditions. The sewer sizes range between 8-inches to 13 feet. Of the total sanitary sewers, 11,226,000 feet (2,126 miles) are less than 18-inches in diameter (79 percent).

As indicated above in **TABLE 4.1.1**, the separate sewer system is grouped into four sub-areas. These areas are illustrated in **FIGURE 4.1.3**. **APPENDIX B** includes detailed descriptions of key sewer collection system components. The following information is included for the main trunk sewers: sewer slope, sewer diameter, approximate street location, sewer segment capacity, ultimate tributary area, and the areas currently served by the identified sewer segment. The description of each sub-area is as follows:

The OSIS tributary area shown in **FIGURE 4.1.3** includes all the separate sanitary sewer system tributary to the OSIS upstream of the combined sewer basin. Each separate sub area is listed below.

- Clintonville Main Trunk Sanitary Sewer
- Olentangy Main Trunk Sanitary Sewer
- Beulah Road Trunk Sewer
- Clinton #3 Trunk Sewer
- Kinnear Road Trunk sewer
- OSIS upstream from the Hudson Street Regulator

TABLE 4.1.5 lists tributary areas to each trunk sewer. **FIGURES B.9.6, B.9.9** and **B.9.10** in **APPENDIX B** illustrate these trunk sewers, and **APPENDIX B** provides an information summary for each of them.

The Scioto Main Trunk Sewer tributary area shown in **FIGURE 4.1.3** includes the separate sanitary sewer system tributary to the OSIS downstream of the combined sewer basin which discharges into the Jackson Pike WWTP. The main trunk sewers in this area are as follows:

- Scioto Main Trunk Sewer (including West Side Sanitary Sewer, West Side Relief Sewer and Castle Road pump station)
- Franklin Main Interceptor Sewer

- Alum Creek Interceptor Sewer and Deshler Tunnel

EXHIBIT 4.1.1 lists tributary areas to each trunk sewer. **FIGURES B.9.7, B.9.11 and B.9.10** in **APPENDIX B** illustrate these trunk sewers, and the appendix provides an information summary for each of them. DOSD replaced the lower reach of the Scioto Main Trunk sewer as part of protecting the west side of Columbus through the West Columbus Local Protection Project. Currently, the West Side Sanitary Sewer and the West Side Relief Sewer discharge into the Scioto Main Trunk Replacement Sewer. Therefore both the West Side Sanitary Sewer and the West Side Relief Sewer are considered as sub-trunk sewers to the Scioto Main Trunk Sewer downstream of the combined sewer area.

EXHIBIT 4.1.1: Separate Sanitary Areas Tributary to the OSIS Downstream of the Combined Sewer Area				
	Trunk Sewer Name	Served Area (acres)	Unserved Area (acres)	Total Area (acres)
1	Scioto Main Trunk Sewer	22,784	36,826	59,610
2	Franklin Main Interceptor Sewer (S. of 2 nd Avenue P.S.)	2,513	759	3,272
3	Alum Creek Interceptor Sewer and Deshler Tunnel	881	22	903
4	Castle Road Pump Station	1,633	1,620	3,253
	Total	27,811	39,227	67,038

The Interconnecting Sanitary Sewer tributary area shown in **FIGURE 4.1.3** includes the separate sanitary sewer systems tributary to the Interconnecting Sanitary Sewer which discharge to the Southerly WWTP. The main trunk sewers in this area are as follows:

- Big Run Sanitary Trunk Sewer
- Williams Road Pump Station
- Sub-Trunk Sewers serving the City of Grove City

EXHIBIT 4.1.2 lists tributary areas to each trunk sewer. **FIGURES B.9.2 and B.9.8** in **Appendix B** illustrate these trunk sewers, and the appendix provides an information summary for each of them.

EXHIBIT 4.1.2: Separate Sanitary Areas Tributary to the Interconnecting Sanitary Sewer				
	Trunk Sewer Name	Served Area (acres)	Unserved Area (acres)	Total Area (acres)
1	Big Run Trunk Sanitary Trunk Sewer	7,927	17,013	24,940
2	Williams Road Pump Station	1,105	1,567	2,672
3	Sub-trunk sewers serving City of Grove City	3,945	19,767	23,712
4	Hell Branch Sanitary Trunk Sewer (not yet constructed)	0	45,120	45,120
	Total	12,977	83,467	96,444

Dry weather flows from the Big Run Sanitary Trunk Sewer and the Williams Road Pump Station are directed to Jackson Pike WWTP. During wet weather flow, excess flows beyond the capacity of Jackson Pike WWTP are directed to the Southerly WWTP through the Interconnecting Sanitary Sewer.

The Big Walnut Sanitary Outfall and Big Walnut Augmentation / Rickenbacker Interceptor (BWARI) tributary area shown in **FIGURE 4.1.3** includes mainly the separate sanitary sewer system tributary to the Southerly WWTP. The main trunk sewers in this area are as follows:

- Alum Creek Area Trunk Sewer
- Big Walnut Sanitary Trunk Sewer
- Blacklick Creek Trunk Sewer
- Big Walnut Sanitary Outfall Sewer
- Big Walnut Augmentation / Rickenbacker Interceptor

EXHIBIT 4.1.3 lists tributary areas of each trunk sewer. **FIGURES B.9.1**, through **B.9.4** in **APPENDIX B** illustrate these trunk sewers, and the appendix includes a brief description of each of them.

EXHIBIT 4.1.3: Tributary Areas of Major Trunk Sewers in the Big Walnut Sanitary Outfall Sewer Tributary Area

	Trunk Sewer Name	Served Area (acres)	Unserved Area (acres)	Total Area (acres)
1	Alum Creek Trunk Sewer	30,659	15,007	45,666
2	Big Walnut Sanitary Trunk Sewer	15,773	42,917	58,690
3	Blacklick Creek Trunk Sewer	8,093	36,440	44,533
4	Big Walnut Sanitary Outfall and Big Walnut Augmentation/ Rickenbacker Interceptor (BWARI)	4,043	74,984	79,027
	Total	58,568	169,348	227,916

4.1.3 Stormwater Collection System

There are approximately 13,656,000 linear feet of storm sewer (2,590 miles) within the City of Columbus corporate boundary. This number includes both publicly and privately maintained storm sewers. Privately maintained storm sewers tend to be associated with parking lot drainage or small developments with roadways that are not deeded to the City and tend to be small diameter sewers (less than 24-inches in diameter). However, some of these private sewers discharge into portions of the Municipal Separate Storm Sewer System (MS4) as defined by the National Pollutant Discharge Elimination System (NPDES) requirements and are considered part of the overall stormwater collection system for this discussion.

The publicly owned and maintained storm sewers within the City range in size from 12-inch diameter to over 96-inches in diameter. Of the total storm sewer system, public and private, 8,454,330 feet (1,600 miles) is less than or equal to 18-inches in diameter (61.9 percent of the total), 1,769,786 feet (335 miles) is between 18 and 24-inches (13 percent of the total), 2,020,340 feet (382 miles) is between 24 and 42-inches in diameter (14.8 percent of the total) and 1,152,303 feet is over 42-inches in diameter (8.4 percent of the total). Approximately 258,000 linear feet of storm sewer (1.9 percent) has an unknown pipe diameter due to incomplete record plan information. The storm sewer system for the City of Columbus typically follows the natural drainage patterns and over 90 percent of the City discharges into one of the four primary watercourses that flow through the City: the Scioto River (approximately 34 percent of the City is naturally tributary to the Scioto), the Olentangy River (approximately 17.5 percent), Alum Creek (approximately 19.5 percent), and Big Walnut Creek (approximately 19.4 percent). The remaining 10 percent of the City is tributary to Blacklick Creek, Little Walnut Creek and Big Darby Creek.

In 1979 the City implemented standard storm sewer design criteria including the requirements that any new storm sewer be built to contain the 2-year rain event in the pipe, and the 5-year rain event would not exceed the top of casting elevation of the system. Large portions of the storm sewer system, predominantly in older parts of the City, were constructed prior to the implementation of this design requirement.

By January 2000, the combined sewer system covered approximately 7 percent of the City of Columbus service area (19 square miles out of a total 271 square miles). This combined sewer system area is served by combined sewers that mix sanitary and storm sewer flow. Within the combined sewer area there is a total of approximately 1,476,000 linear feet (279.5 miles) of storm sewer which includes some storm sewer lines that discharge into combined sewer lines. The total is comprised of approximately 865,000 feet of pipe that is less than or equal to 18-inches in diameter (58.6 percent of the total), 142,898 feet is between 18 and 24-inches in diameter (9.7 percent of the total), approximately 191,000 feet is between 24 and 42-inches in diameter (13 percent of the total) and approximately 193,000 feet is over 42-inches in diameter (13.1 percent of the total). Approximately 83,400 linear feet of storm sewer (5.6 percent) has an unknown pipe diameter.

FIGURE 4.1.7 illustrates runoff catchments in the combined sewer area. At the far southern end of the combined sewer service area, there is a portion of the storm sewer that is separate from the sanitary sewers. The sanitary sewers in this area discharge into combined sewers. The separate storm sewer system in this area is comprised of approximately 288,000 total feet of storm sewer, approximately 157,000 feet of pipe is less than or equal to 18-inches in diameter (54.5 percent of the total), approximately 24,000 feet of that pipe is between 18 and 24-inches in diameter (8.5 percent of the total), approximately 41,000 feet is between 24 and 42-inches in diameter (14.3 percent of the total) and approximately 54,000 feet is over 42-inches in diameter (18.7 percent of the total). Approximately 11,500 linear feet of storm sewer (4 percent) has an unknown pipe diameter.

Within the total combined sewer area, nearly the entire storm sewer system was constructed prior to the adoption of the previously mentioned design standards.

4.1.4 Pump Stations

For reliability and reduced maintenance cost reasons, the City of Columbus, DOSD prefers to use gravity sewers in its sewer collection system. However, because of construction infeasibility and large costs associated with deep gravity sewers, there are locations that are served by pump stations. An inventory was compiled of the sanitary pump stations within the Columbus Service Area. A total of 28 pump stations were identified. 16 of the pump stations are privately owned and 12 are owned by the City of Columbus. **APPENDIX B** includes an inventory of the identified pump stations which includes the following characteristics of each pump station:

- Location
- Plan number and IMS number
- Influent sewer size, direction, and invert elevation
- Wet well characteristics including diameter, top of casting, invert elevation, maximum operating elevation, effective wet well volume, and wet well storage capacity
- Pump characteristics
- Outlet information including force main size, pump capacity, motor horsepower, and discharge sewer information

- Overflow location and discharge points
- Treatment plant to which the pump station is tributary

EXHIBIT 4.1.6: lists key pump stations and corresponding capacity that affects the operation and performance of the sewer collection system.

EXHIBIT 4.1.6: Key In-Line Pump Stations and Headworks Configuration*		
ID	Description	Maximum Capacity (MGD)
1	2 nd Avenue pump station	10.8
2	Castle Road pump station	13
3	Williams Road pump station	23
4	Headworks at Jackson Pike WWTP	102
5	Bypass pump station to receiving water at Jackson Pike WWTP	73
6	Interconnection Pump Station (IPS)	80
7	Headworks at Southerly WWTP	225

*Based on January, 2005 data

4.1.5 Foundation System

In addition to the existing system described in this section, a number of collection system components were used in the base line model because these projects would be completed at the time the wet weather improvements would begin. For a detailed description, see end of **SECTION 4.2.**

4.1.6 Satellite Communities

Satellite collection systems are sewer systems owned by other entities within the City of Columbus sewer service area. The City is bound by contract to accept each satellite's sanitary flow, but does not provide maintenance or operational support to the satellites' wastewater collection or stormwater collection systems. There are currently 22 suburban satellite collection systems that discharge into the City of Columbus' wastewater collection system. Additionally, there are 20 smaller areas within the boundaries of Franklin County, as well as the Jefferson Water and Sewer District, that are satellite collection systems. **FIGURE 4.1.9** shows the location of each suburban satellite system that contributes wastewater flow to the City's system. **TABLE 4.1.6** lists the tributary areas of suburban satellite collection systems that discharge to the City's publicly owned treatment works (POTW).

There are several maintenance contract areas that discharge into the City of Columbus wastewater collection system. Maintenance contract areas are areas outside the corporate limits of the City of Columbus where Columbus is bound by contract to provide maintenance of the non-City owned sewers, as well as accept the sanitary flow from the areas. The maintenance contract areas include portion of both Franklin County and the Village of Valleyview. **FIGURE 4.1.10** shows the location of each maintenance contract area and each satellite area that is within

Franklin County that contributes wastewater flow to the City's system. **TABLE 4.1.7** is a list of maintenance and satellite collection areas within Franklin County and their corresponding sewer drainage areas.

4.1.7 Service Area Population

The service area population for the greater Columbus area has been determined by using population and mapping information obtained from the Mid Ohio Regional Planning Commission (MORPC). City, County, and suburban municipal boundaries were combined into a single service area shape and then overlaid onto traffic analysis zone (TAZ) mapping that contains underlying population attribute data. Population information from the resulting intersection was tabulated and summed to determine a total service area population of 985,766. Where the service area shape intersected an incomplete TAZ, the population for the entire TAZ was assumed to be evenly distributed and then multiplied by the proportion of the area of the TAZ after intersection to the area of the TAZ before intersection.

Franklin County sewer service limits were determined from the information contained in the 2003 *Agreement between the City of Columbus, Ohio and The Board of Commissioners of Franklin County, Ohio*.

Small portions of the City of Columbus' sewer system discharge to treatment facilities operated by Delaware County. Conversely, portions of Delaware County's sewer system discharge to treatment facilities operated by the City of Columbus. The 1991 *Agreement for Sanitary Service between Delaware County and the City of Columbus* provides details of these sewer discharge arrangements. For this analysis the flow to Delaware County is assumed to be approximately equal to the flow to the City of Columbus. Any differences in the flow between these areas are assumed to be within the accuracy limits of the estimating procedure.

4.1.8 Overflow Frequency and Volumes

This section discusses the overflow frequencies and volumes for CSOs, SSOs, and WIBs.

4.1.8.1 CSOs

Columbus has about 5000 acres of combined sewer runoff catchment area with an additional 7000 acres of separate sewer tributary to the CSS system and. These are 32 regulated CSO relief locations which consist of CSO regulators, manhole relief points, the Alum Creek Storm Tank (ACST), and the Whittier Street Storm Tanks (WSST). These relief locations are monitored by two types of flow meters. The first type is the ADS model 3500 meter, which measures ultrasonic depth, pressure depth, and velocity. The second type is the Sigma Model 920 AV Flow meters. Meters include boards for an area-velocity (A/V) probe, down-looking ultrasonic (DLUS) probe, modem, rain gauge, and autosampler. Meters provide time series flow data which can then be analyzed to determine the timing and duration of overflow events.

The City of Columbus CSO Consent Order states in paragraph 12 that “*“CSO Event” shall mean one or more overflows from the CSS as the result of a precipitation event that does not receive minimum treatment.*” CSO events are thus counted on a system wide basis; in other words if 1 or 5 regulators discharge as the result of a single rain event, it is one CSO event. This

report uses a 6 hour inter-event duration to identify overflows likely caused by the same precipitation event. In addition to CSO events, this report also uses the term “CSO activation.” A CSO activation is any discharge from a regulator as the result of a single rain event (again using the 6 hour interval to define separate rain events); in other words, if a single rain event causes 5 regulators to discharge, that is counted as five CSO activations.

CSO data from January 1, 2000 to October 31, 2004 were analyzed to determine the number of CSO activations. A summary of regulator and storm tank activity can be found in **TABLE 4.1.8**. In addition to variation in the number of overflows at each CSO location, there is considerable variation in the volume released at each location. A summary of the overflow volumes can be found in **TABLE 4.1.9**.

Two main conclusions can be drawn from **TABLES 4.1.8** and **4.1.9**. First, the WSST facility is the structure where the majority of CSOs in Columbus occur. In fact, from 1/1/00-10/31/04, the WSST facility accounted for about 87 percent of the CSO volume discharged in Columbus. Secondly, most of the CSO regulators discharge a small amount of combined sewage in Columbus. During the almost four years of data analyzed here, 13 of the 19 CSO regulators in Columbus did not have an activation exceeding 10 MG.

The SSCM model was also used to evaluate the performance of the existing system. The overflow occurrences and volumes can be found in **TABLE 4.1.10**. The relative magnitudes of the overflow volumes from the CSOs in the ES2005 model results are reflective of the historical data. The WSST is responsible for the vast majority of the CSO volume in the system, in this case 85 percent of the total overflow volume from the combined system. Moreover, only 9 of the 32 listed CSO overflow locations had a total overflow volume larger than 10 MG for the typical year, a trend which is also reflective of the historical data.

4.1.8.2 SSOs

This section summarizes historical SSO overflow data for the years 2002 to 2004, inclusive. The City’s SSO monitoring, reporting and response procedures are also discussed.

The SSO Consent Order defines an SSO as *“an overflow, spill, or release of wastewater from a sanitary sewer system, including interceptors sewers. SSO(s) do not include combined sewer overflows or other discharges from the combined portions of a combined sewer system. An SSO that occurs on a city street has the potential to reach waters of the state without treatment, and therefore, meets the definition of and overflow. SSO(s) do not include WIB(s) unless the wastewater is discharged or otherwise released to the street.”*

There are two main sources of SSOs that occur in the sewer system; those that occur at designed sanitary relief structures (DSRs) and those that occur at locations other than DSRs, e.g., manholes, pipe breaks, etc. SSOs are classified as wet-weather events or dry-weather events. Wet-weather overflows occur when excessive inflow and infiltration exceeds the conveyance capacity of the sanitary sewer and flows escape from the system. Historically, dry-weather events account for less than two percent of all overflows observed in the Columbus sewer system. Dry-weather overflows are typically attributed to issues other than lack of capacity such as blockages in the sewer from pipe failure, roots, grease, and vandalism. Wet-weather events must be reported monthly to the Ohio EPA in monthly and annual reports. Dry-weather events, upon

verification, are reported immediately to the Ohio EPA as well as included in the monthly and annual reports.

DSRs are structures in the sanitary collection system that are designed to provide relief to a hydraulically overloaded sewer during wet weather events. These structures were built primarily to reduce elevated hydraulic grade lines that resulted in system surcharging and localized flooding during periods of excessive storm runoff. Most DSRs consist of pipes that are constructed at critical elevations in manholes and connected to a storm sewer or discharge directly to a waterway. If the water level in the sanitary sewer rises to the elevation of the overflow pipe, the excess flow is diverted through the overflow pipe.

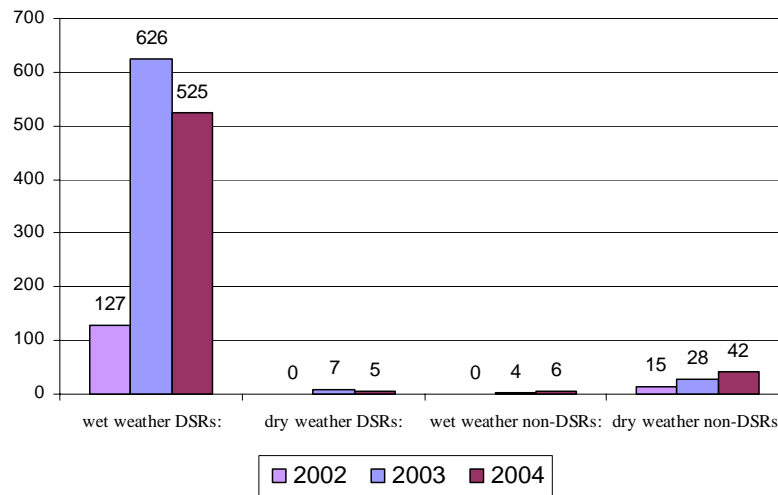
All DSRs are inspected weekly by DOSD maintenance personnel. All SSOs that occur at DSRs are tracked based on the results of these inspections. DOSD has been inspecting DSRs and tracking their activity since August, 2002. SSOs occurring at locations other than DSRs and chronic non-DSR SSO locations are tracked as they are reported to DOSD. When a suspected overflow is reported to the SMOC Dispatch Office, a response crew is mobilized to confirm the report, execute emergency response if necessary, perform overflow mitigation, and complete the proper SSO documentation.

Several DSR sites have been fitted with electronic flow monitors that record the time, duration, and volume of an overflow event. DSRs that do not have flow monitors utilize a monitoring method known as “chalk and block”. This method consists of a block of wood on a string that hangs in the structure and colored chalk that is applied to the invert of the overflow pipe. If the chalk has been washed away and the block has been pulled into the overflow pipe it is assumed that an overflow has occurred since the date of the last inspection. For reporting purposes, an overflow “event” is defined as one or more overflow “occurrences” within a 24 hour period, from midnight to midnight. If the occurrence continues past midnight, into the next day, it is considered two events.

A report called the *Annual SSO and WIB Report* is submitted by February 15 each year and contains more details on SSO and WIB occurrences.

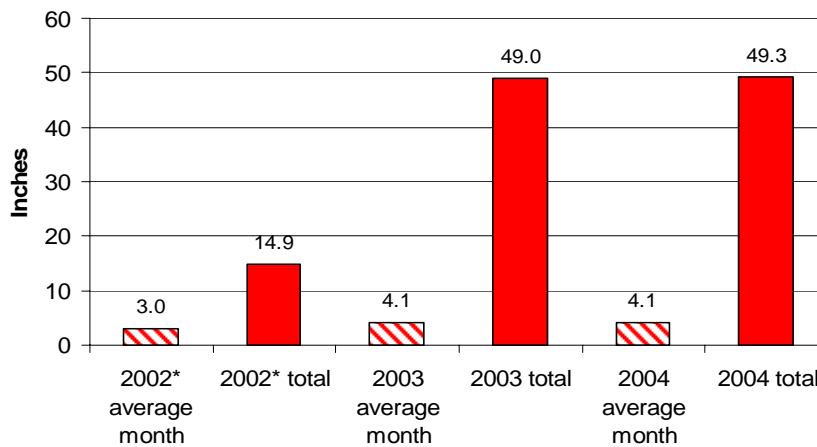
EXHIBIT 4.1.7 shows historical overflow data from 2002 through 2004 classified by sanitary sewer overflow type. As noted, overflow data was only collected for the last five months of 2002. **EXHIBIT 4.1.8** shows historical rainfall data as reported by Port Columbus International Airport.

EXHIBIT 4.1.7: Historical SSO Activity, 2002-2004



Notes: The City began tracking SSO activity in August, 2002 as required by the SSO Consent Order
2004 numbers are provisional pending completion and approval of 2004 Annual SSO Report

EXHIBIT 4.1.8: Historical Rainfall Data, 2002-2004



***2002 numbers indicate rainfall totals from August through December**
Note: Rainfall data reported by Port Columbus International Airport

FIGURES 4.1.11 - 4.1.13 are maps of the greater Columbus area showing overflow frequencies at DSR locations in each of the years 2002 to 2004. Selected observations from the historical data are given below.

- The storm event occurring in 2003 on August 29 and 30 produced 3.72 inches of rain and was responsible for the occurrence of 25 SSOs. This represents 5 percent of the total SSOs in 2003.
- The storm event occurring in 2004 on January 1 through January 5 produced 4.04 inches of rain and was responsible for the occurrence of 110 SSOs. This represents approximately 21 percent of the total SSOs occurring in 2004.
- The most active DSR location in 2003 was COC# 205 located in the manhole at Bruck Street and the alley north of Hosack Street. with 37 overflows for the year. This represents 7.3 percent of the total SSOs occurring in 2003.
- The most active DSR location in 2004 was COC# 83 located just east of the Whittier Street Storm Tanks with 37 overflows for the year. This represents 7 percent of the total SSOs for 2004.

No observations have been presented for 2002 because overflow data was not tracked before August, 2002.

4.1.8.3 Water-in-Basement (WIB)

This section summarizes historical WIB occurrences for the years 2002 to 2004, inclusive. The City's WIB reporting and response procedures are also discussed.

The SSO Consent Order defines Water-in-Basement as the following: *"wastewater backups into buildings that are caused by blockages or flow conditions in a sanitary sewer other than a building lateral. WIB(s) do not include the backup of sewage caused by a blockage or other malfunction in the building's lateral sewer."*

Water-in-Basement occurrences (WIBs) occur when wastewater enters a basement through the floor drains due to sanitary sewer backups in public sewers. WIBs most often occur during rain events or wet weather, but can also take place during dry weather as a result of pipe failures. Property flooding problems that are not related to the sanitary sewer are usually the result of blocked gutters and downspouts, improperly designed foundation drains, insufficient property drainage or malfunctioning sump pumps. Wet weather can also cause WIBs due to sanitary sewer backups resulting from excessive infiltration and inflow (I/I) and/or pipe failures. City maintenance personnel currently track WIBs by responsibility and are developing a system to track WIB by cause.

Sanitary sewer backups into basements can be the result of private property issues as well as public property issues; however, these backups are not included within the definition of WIB in the Consent Order. Private property issues that can result in a WIB include sewer lateral blockage or damage and improper connections of downspouts and foundation drains to the sewer lateral. Private sewer lateral blockage can result from root intrusion and grease or debris buildup. Damage to private sewer laterals can occur from root intrusion as well as degradation as the sewer lateral ages. During rain events, sewer laterals can quickly become overloaded if downspouts and foundation drains are connected. Public property issues can also cause WIBs. Mainline sanitary sewer damage and blockages caused from root intrusion, grease and debris

buildup, and deficient sewer pipes can result in WIBs upstream of the blockage. Excessive I/I can create surcharged conditions, which can cause WIBs.

Water-in-basement complaints are taken by the city's 24-hour Sewer Maintenance Operations Center (SMOC). Not all complaints received are caused by public sewers within the City of Columbus. The City is not responsible for WIBs that occur as the result of a private property issue including sewer lateral blockage or damage and stormwater connections to the sanitary sewer lateral.

When complaints are received, a Service Request is filed for SMOC crews to visit the residence for investigation. The Service Requests are recorded in a computer database which is used for historical information and annual reporting. As a requirement of the Consent Order, the City of Columbus annually reports all WIBs that are the City's responsibility. In the *Annual SSO and WIB Report* for the years 2002, 2003, and 2004, the total number of City responsible WIBs is reported for the City's sewer subbasins. **EXHIBIT 4.1.9** summarizes the information given in the annual reports.

EXHIBIT 4.1.9: Summary of WIB Occurrences			
Subbasin	2002 (Aug – Dec)	2003	2004
Alum Creek	39	153	221
Olentangy Scioto Interceptor Sewer	48	120	157
Big Run Sanitary Trunk Sewer	13	35	56
Scioto Main Trunk Sewer	10	24	52
Big Walnut	6	11	16
Blacklick	0	3	6
TOTAL	116	346	508

FIGURES 4.1.14 - 4.1.16 show the general locations for the City responsible WIB occurrences in 2002, 2003, and 2004, respectively. The figures show WIB occurrences during both wet weather and dry weather. The City responsible WIB occurrence history does not distinguish between wet weather and dry weather WIB occurrences because the complaints are not necessarily taken on the day of a rain event or on the day that the WIB occurred.

EXHIBIT 4.1.10 shows an estimated percentage of dry weather WIBs versus wet weather WIBs based on the assumption that wet weather WIB complaints are taken on the day of a rain event and up to two days after completion of the rain event. This assumption considers only the rain events which are recorded at the Columbus International Airport.

EXHIBIT 4.1.10: Wet Weather vs. Dry Weather WIB Occurrences			
	2002 (Aug – Dec)	2003	2004
Wet Weather	72 percent	86 percent	89 percent
Dry Weather	28 percent	14 percent	11 percent

EXHIBIT 4.1.10 demonstrates that WIBs are much more likely to occur during wet weather conditions than dry weather conditions. It is difficult to ascertain from the available data if the wet weather WIBs are due primarily to (1) capacity limitations in conveyance facilities during periods of excessive wet weather flow, or to (2) blockages or other defects which impose capacity limitations and result in backups during wet weather events. In the former case, I/I is primarily to blame. In the latter case, while elevated flows may be partly responsible, blockages or other defects exacerbate the conditions which result in WIBs.

4.1.9 Operational Strategies

Operational strategies for the wastewater collection systems are very closely associated with those for the WWTPs. Therefore, operational strategies for both shall be discussed in Section 4.2.5.

4.2 Wastewater Treatment Plants

The City of Columbus DOSD is serviced by two treatment plants: Jackson Pike Wastewater Treatment Plant (JPWWTP) and Southerly Wastewater Treatment Plant (SWWTP). **FIGURE 4.2.1** shows the locations of these two wastewater treatment plants.

4.2.1 Jackson Pike Waste Water Treatment Plant (JPWWTP)

The smaller of the two treatment plants, JPWWTP, has an average design flow rate of 68 MGD and a peak design flow rate of 102 MGD. The plant is divided into two treatment trains, A Plant which handles an average of 42 MGD and B Plant which handles an average of 26 MGD. A Plant has four 0.9 MG primary clarifiers, eight 2.6 MG aeration basins and nine 0.86 MG final clarifiers. B Plant has four 0.9 MG primary clarifiers, four 2.6 MG aeration basins, and five 0.86 MG final clarifiers. The chlorination for the entire plant occurs in two 1 MG tanks with a detention time of 18.6 min at peak flow rate. **FIGURE 4.2.2** shows the current layout at JPWWTP.

Columbus has a little over 5000 acres of combined sewage runoff catchment area in the downtown area. This combined sewer area experiences elevated flow rates during rain storms. Wastewater generated in this area is first directed towards JPWWTP. If the flow rate at the plant exceeds the peak capacity of the plant, excess wastewater is sent to SWWTP by means of the Interconnecting Sanitary Trunk Sewer.

4.2.1.1 Outfall 002 and Outfall 003

JPWWTP has two permitted outfalls which are designed as bypasses, Outfall 002 and Outfall 003. Outfall 002 is a gravity bypass at the wet well for raw sewage, and is located before any pretreatment or screening. Outfall 003 is a pumped bypass from the headworks, which is situated after screening, but before pretreatment. Both outfalls discharge into the Scioto River.

Outfall 002 is designed to bypass if influent flow rate exceeds the capacity of the headworks or if there are technical difficulties with the screening facilities. Outfall 003 is designed to bypass if the influent flow rate to the headworks exceeds the peak capacity of the plant. The headworks have a capacity of 230 MGD, which is 128 MGD higher than the peak flow rate of Jackson Pike.

Outfall 002 and Outfall 003 are permitted under NPDES permits numbers 4PF00000002 and 4PF00000003 respectively.

Outfall 002, i.e. the gravity bypass, was constructed in the mid 1930s. Outfall 003, i.e. the mechanical bypass, came online in 2004. Outfall 002 overflowed on 3/28/05 due to an upset at the plant, which was the first confirmed overflow dating back to 1989. Outfall 003 activated for the first time in January 2005.

4.2.2 Southerly Waste Water Treatment Plant (SWWTP)

SWWTP has an average design flow rate of 114 MGD and a peak design flow rate of 200 MGD. SWWTP is divided into three treatment trains: East, Center, and West. East and West trains have an average design flow rate of 42.75 MGD while Center train has an average design flow rate of 28.5 MGD. West train has four 1.5 MG primary clarifiers, six 2.6 MG aeration basins, and three 4.0 MG final clarifiers. Center Train has four 1.0 MG primary clarifiers, four 2.6 MG aeration basins, and three 4.0 MG final clarifiers. East train has two 2.9 MG primary clarifiers, six 2.6 MG aeration basins, and three 4.0 MG final clarifiers. The chlorination for the plant takes place in two 1.2 MG tanks with a detention time of 22.6 min at peak flow rate.

FIGURE 4.2.3 shows the current layout at SWWTP.

4.2.2.1 Outfall 002

This section summarizes historical data for the permitted Outfall 002, the Southerly Bypass, which is located at the Southerly Wastewater Treatment Plant. Outfall 002 is located at the north end of the Southerly Wastewater Treatment Plant and begins at the bypass chamber at the north end of the screening chamber. Bypass flows do not currently receive any pretreatment or screening processes before discharge. The 108-inch diameter bypass piping runs westward, north of the digesters and ash lagoons, and discharges into the Scioto River.

Outfall 002 is activated when wastewater flow rates exceed the existing pumping capabilities of the headworks influent pumps. The normal wet well elevation (1929 NVGD) of the influent pump station is 677.30 feet. The maximum influent pump station wet well elevation is 681.00 feet. The bypass overflow elevation at the weir crest is also 681.00 feet.

Bypass activities at Southerly Wastewater Treatment Plant are regulated by the NPDES Permit number 4PF00001*LD. The Ohio EPA ID number for bypass-002 is 4PF00001002.

When the existing Southerly Headworks was originally constructed in the early 1960s, Outfall 002 was built as a combined sewer discharge point because it was, and is presently, downstream of the east central area within the City of Columbus served by combined sewers tributary to the Alum Creek Storm Tank.

The City of Columbus, DOSD has been recording bypass data since March, 1997. Bypass volume is recorded and submitted to the Ohio EPA as a daily total. Bypasses may be within the same day or may extend over two or three days according to storm durations. **TABLE 4.2.1** shows historical bypasses occurring in the time period from January, 1998 through December, 2004. In this table, for bypasses that occurred over multiple days, the bypass volumes have been added together to represent the total bypass volume for the entire storm event.

4.2.3 Flows and Loads (Historic-2003)

Currently, JPWWTP and SWWTP have an average design capacity of 68 MGD and 114 MGD respectively. Both the flow rates and the mass loadings at the treatment plants are expected to increase as the service population increases. Since there is no available land for expansion at JPWWTP, any future expansion of the service population will likely be accommodated at SWWTP. Projected increases in the overall mass loadings of the plants, as

provided in the *Draft 2001 General Engineering Report (GER01)*, are summarized below in **EXHIBIT 4.2.1**.

EXHIBIT 4.2.1: Mass Loadings at SWWTP and JPWWTP 2000-2030.				
Year	TSS lb/day	CBOD₅, lb/day	TKN, lb/day	NH₃, lb/day
JPWWTP				
2000	125,900	127,900	18,100	10,600
2008	125,100	127,100	18,000	10,500
2015	125,100	127,100	18,000	10,500
2030	125,100	127,100	18,000	10,500
SWWTP				
2000	168,100	127,400	23,600	13,400
2008	175,300	134,600	25,900	13,200
2015	217,300	171,000	32,500	16,900
2030	314,700	255,300	47,800	25,400

TSS=Total Suspended Solids
 CBOD₅= Five day Carbonaceous Biochemical Oxygen Demand
 TKN=Total Kjeldahl Nitrogen
 NH₃=Ammonia

The Ohio EPA sets permit limits through the NPDES for the concentration and mass load of parameters in the effluent stream of both JPWWTP and SWWTP. There are different permit limits set for different times of the year based upon whether the receiving water body, in this case the Scioto River, will be used for primary contact activities like swimming and fishing. The three different permit periods for the Columbus treatment plants are May, June-October, and November-April. The permit limits for major water quality parameters for these different periods are shown below in **EXHIBIT 4.2.2**.

EXHIBIT 4.2.2: Permit limits for SWWTP and JPWWTP*.

	SWWTP				JPWWTP			
	Concentration (mg/L)		Loading (kg/day)		Concentration (mg/L)		Loading (kg/day)	
	30 day	7 day	30 day	7 day	30 day	7 day	30 day	7 day
TSS (Jun-Oct)	16	24	6,904	10,356	16	24	4,117	6,175
TSS (Nov-Apr)	30	45	12,945	19,417	30	45	7,719	11,579
TSS (May)	26	39	11,219	16,828	26	39	6,690	10,035
Nitrogen, NH ₃ (Jun-Oct)	1	1.5	431	647	1	1.5	257	386
Nitrogen, NH ₃ (Nov-Apr)	3.4	5.1	1,467	2,201	4.5	6.8	1,158	1,750
Nitrogen, NH ₃ (May)	2	3	863	1,294	2.5	3.75	643	965
Fecal Coliform	1,000	2,000			1,000	2,000		
CBOD ₅ (Jun-Oct)	8	12	3,452	5,178	8	12	2,058	3,088
CBOD ₅ (Nov-Apr)	25	40	10,787	17,529	20	30	5,146	7,719
CBOD ₅ (May)	13	19.5	5,609	8,414	13	19.5	3,345	5,018

*JPWWTP permit values from Ohio EPA Permit No. 4PF00000*KD and SWWTP permit values from Ohio EPA Permit No. 4PF00001*LD.

Both treatment plants record influent and effluent flow rates and concentration on a daily basis. Flow rate measurements are composites taken over a 24 hour period. Influent and effluent concentrations are flow-weighted composites also taken over a 24 hour period. Flow-weighted means that a proportional amount of sample is taken based on the flow rate at the time of sample collection. Load values are then calculated by multiplying the concentration and flow rates. For both plants, influent samples are taken after screening but before flow is split to the different trains. Effluent samples are taken after dechlorination.

The flows and loads which arrive at the plant vary both daily and throughout the year. **EXHIBITS 4.2.3-4.2.6** show daily loads at SWWTP from 1998-2003.

EXHIBIT: 4.2.3 SWWTP Daily Flow Rates by Year (1998-2003)

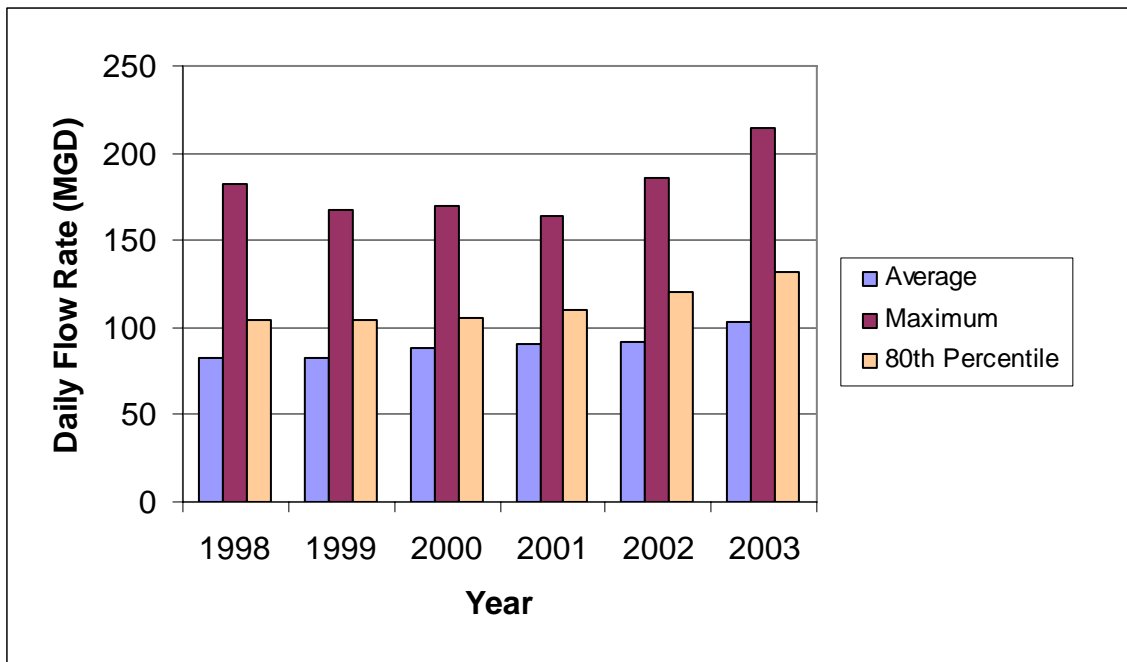


EXHIBIT 4.2.4: SWWTP Daily TSS Loads by Year (1998-2003)

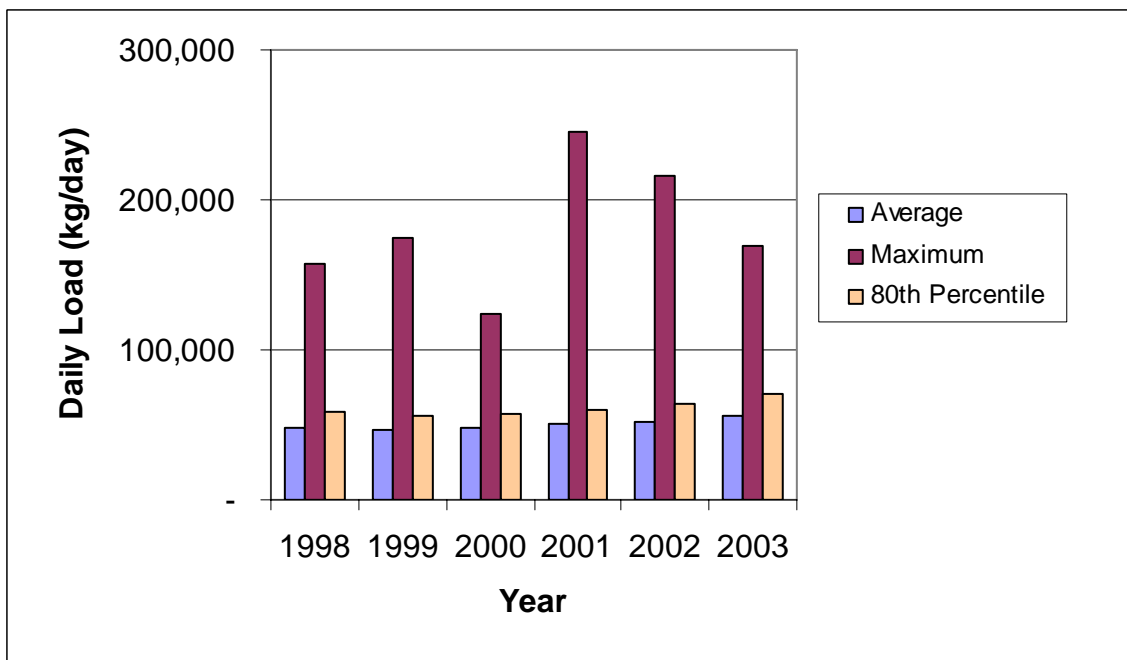


EXHIBIT 4.2.5: SWWTP Daily Influent CBOD Loads by Year (1998-2003)

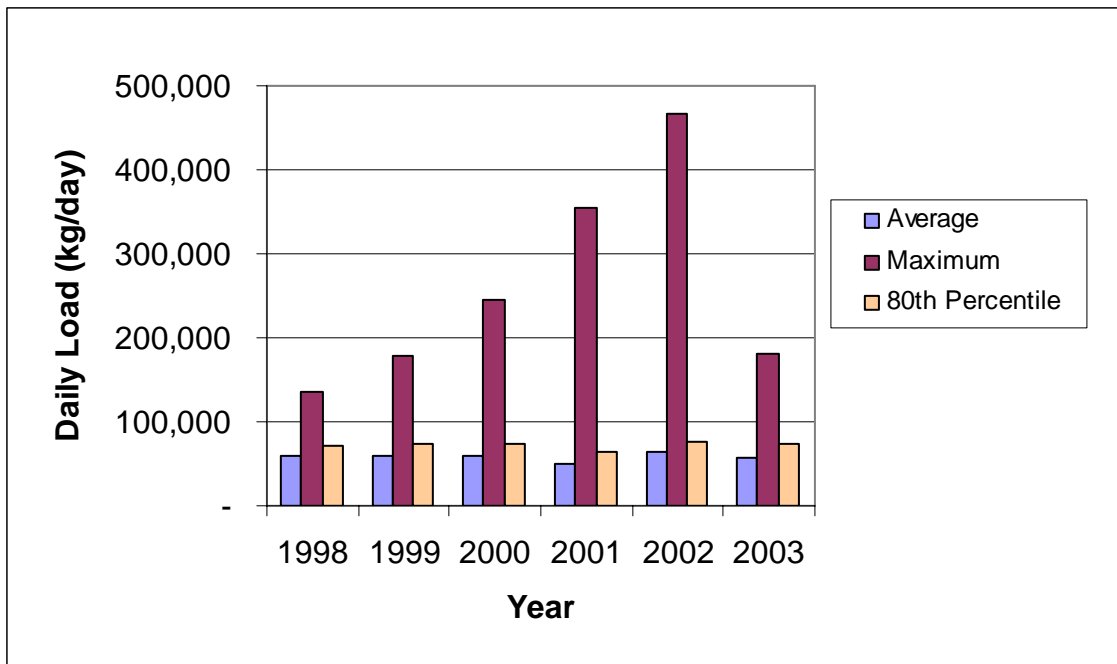


EXHIBIT 4.2.6: SWWTP Daily Influent NH₃ Loads by Year (1998-2003)

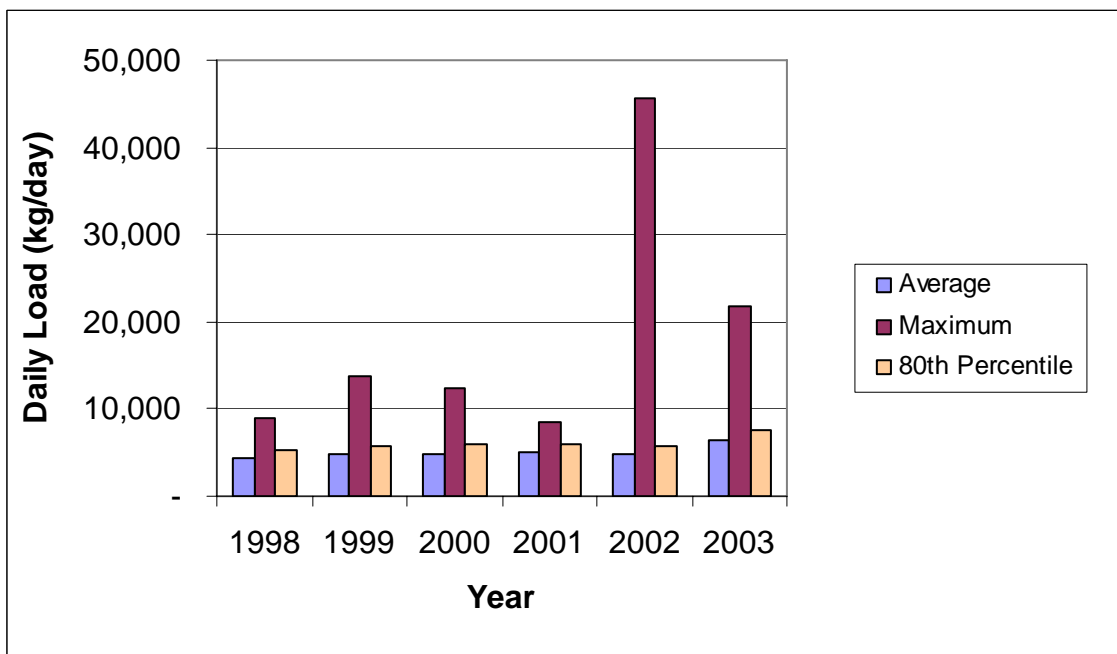


EXHIBIT 4.2.3 shows that average daily flow values for SWWTP gradually increased from 1998-2003. The higher peak value for 2003 reflects the completion of the ninth final

clarifier, which increased the peak capacity of the plant by 25 MGD. **EXHIBITS 4.2.4-4.2.6** show that the average plant loads have remained relatively constant from 1998-2003, although TSS and NH_3 show slightly increased average and 80th percentile loads in the later years. The figures also indicate that peak daily loads can be much higher than average loads, sometimes by an order of magnitude.

EXHIBITS 4.2.7-.2.10 show daily flow rates and loads at JPWWTP from 1998-2003.

EXHIBIT 4.2.7: JPWWTP Daily Influent Flow Rates by year (1998-2003)

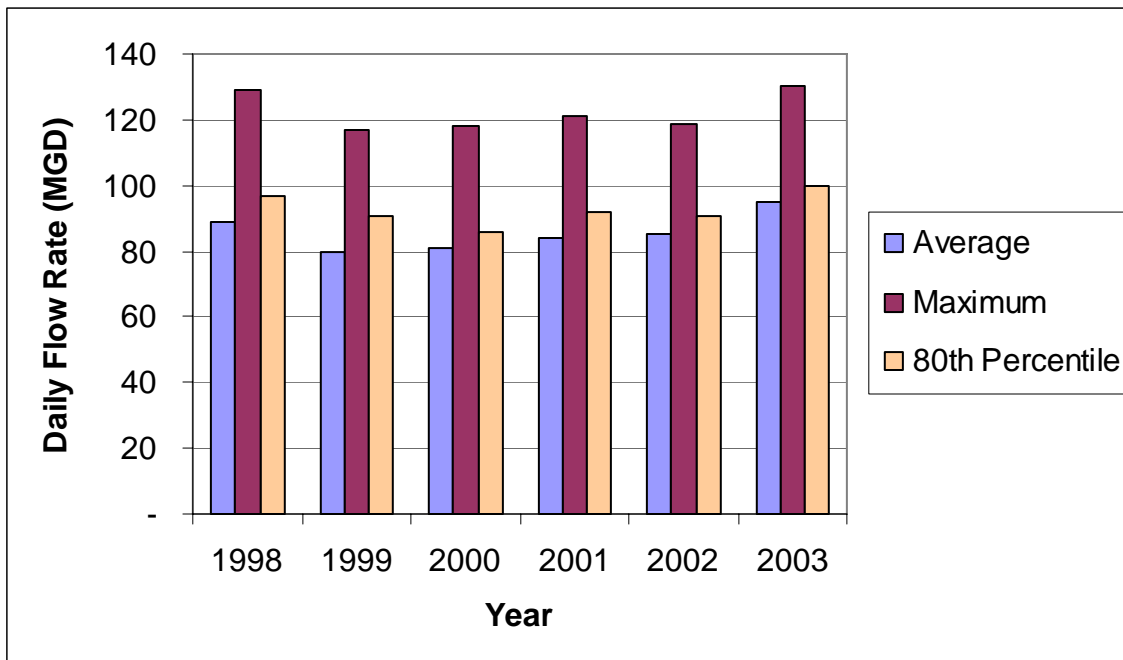


EXHIBIT 4.2.8: JPWWTP Daily Influent TSS Loads by Year (1998-2003)

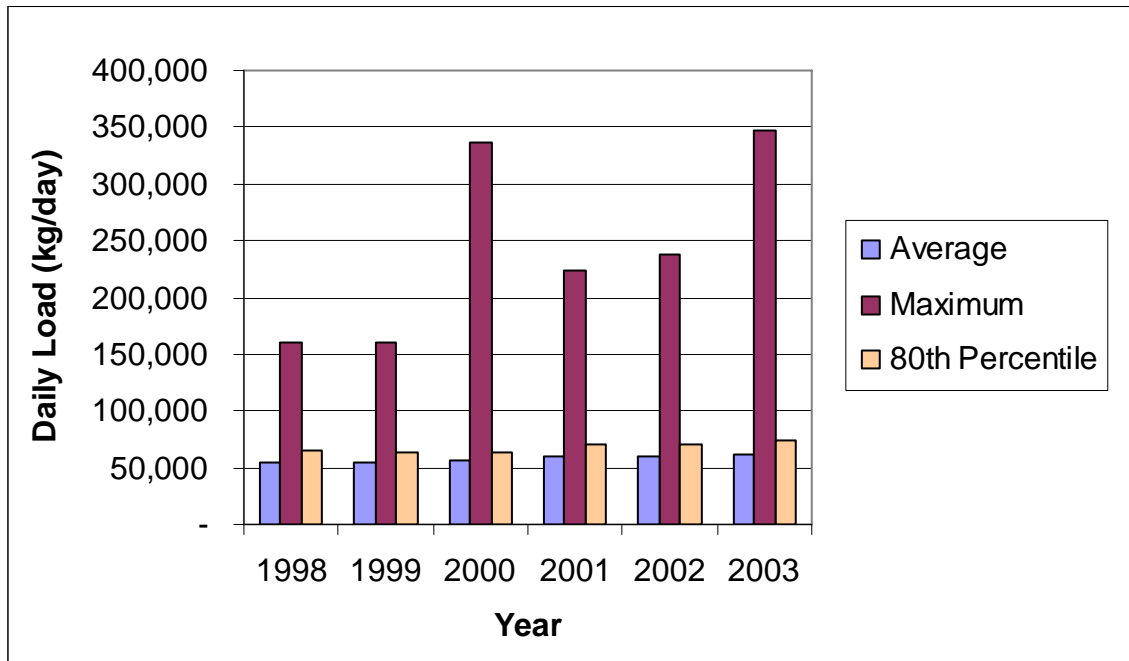


EXHIBIT 4.2.9: JPWWTP Daily Influent CBOD Loads by Year (1998-2003)

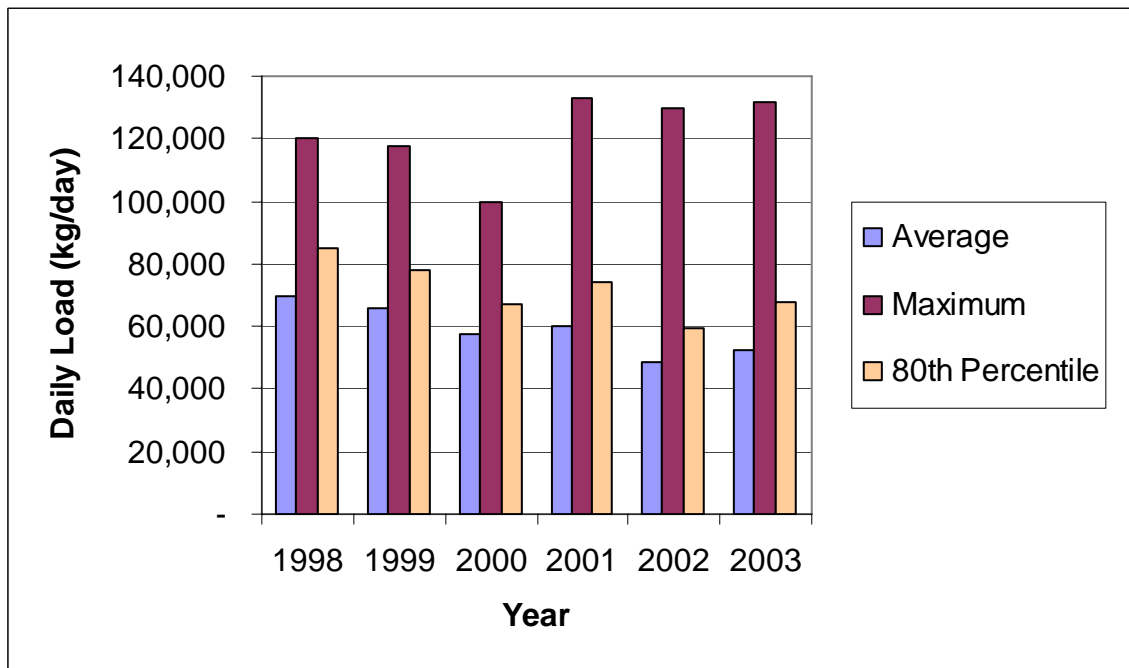


EXHIBIT 4.2.10: JPWWTP Daily Influent NH₃ Loads by Year (1998-2003)

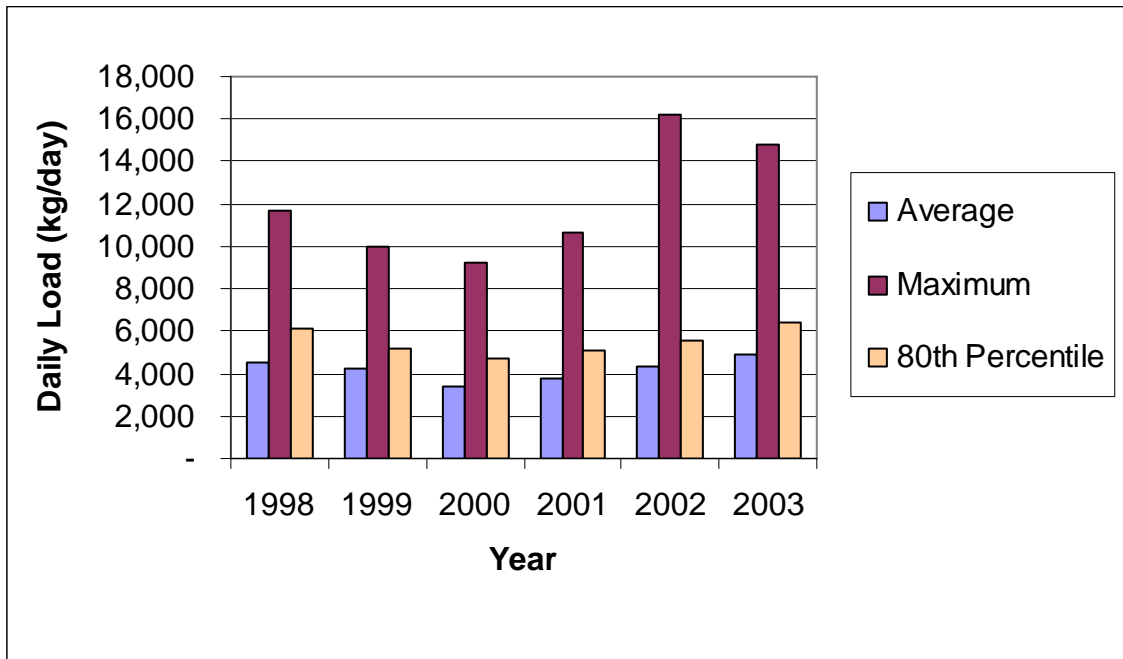


EXHIBIT 4.2.7 shows that average daily flow values for JPWWTP fluctuated slightly from 1998-2003, but did not show a significant increasing or decreasing trend. This is logical since Jackson Pike has been operating at capacity in recent years, with SWWTP handling the increases in flow, receiving excess flow from JPWWTP by means of the Interconnector Sewer. Average daily TSS and NH₃ loads have not changed dramatically, while CBOD loads have shown a slight decrease. In contrast, the peak loads at JPWWTP have been higher in recent years.

When comparing the two plants, SWWTP tends to have higher flows than JPWWTP. Although the average flows are close, the peak flows are much higher at SWWTP. This reflects the fact that SWWTP has more capacity available which is not normally used for accommodating base flows. A comparison of daily loads shows that loads are comparable between the plants. SWWTP tends to have higher CBOD and NH₃ loads, while JPWWTP tends to have higher TSS loads. The reason JPWWTP has higher TSS loads despite lower flows may be because that JPWWTP services the combined sewer service area.

In addition to varying over the years, daily flows and loads also fluctuate on a monthly basis. **EXHIBITS 4.2.11-4.2.14** illustrate the average daily flow rate and loading at SWWTP from 1998-2003 by month.

EXHIBIT 4.2.11: SWWTP Average Daily Flow Rate by Month (1998-2003)

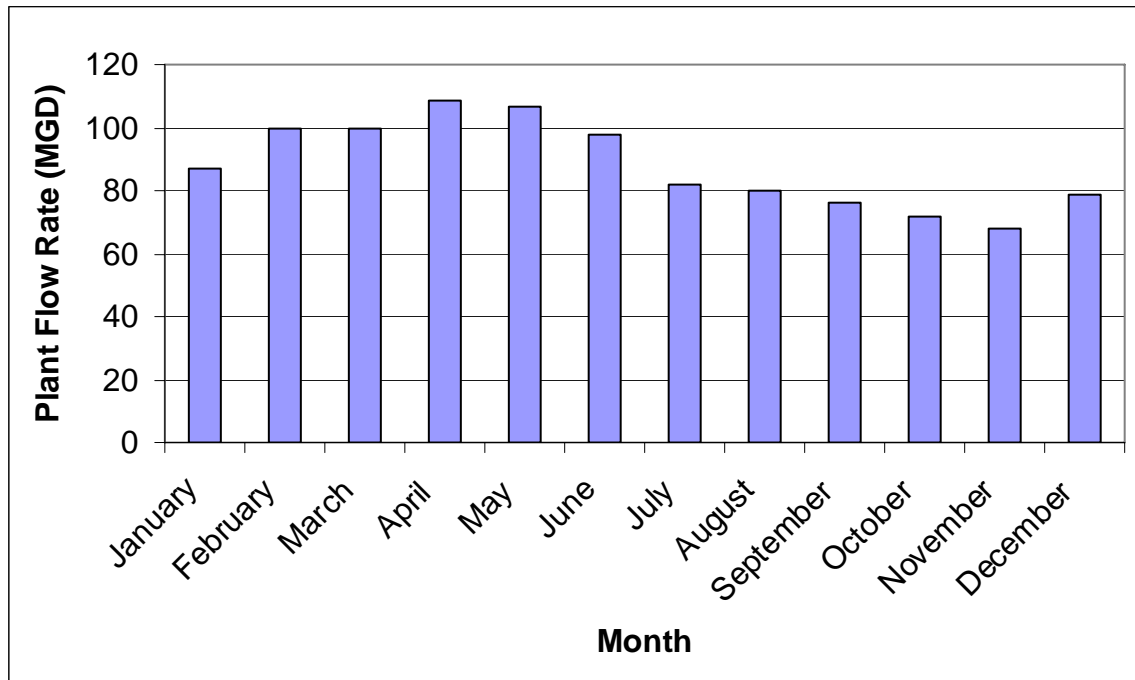


EXHIBIT 4.2.12: SWWTP Average Daily Influent TSS Load by Month (1998-2003)

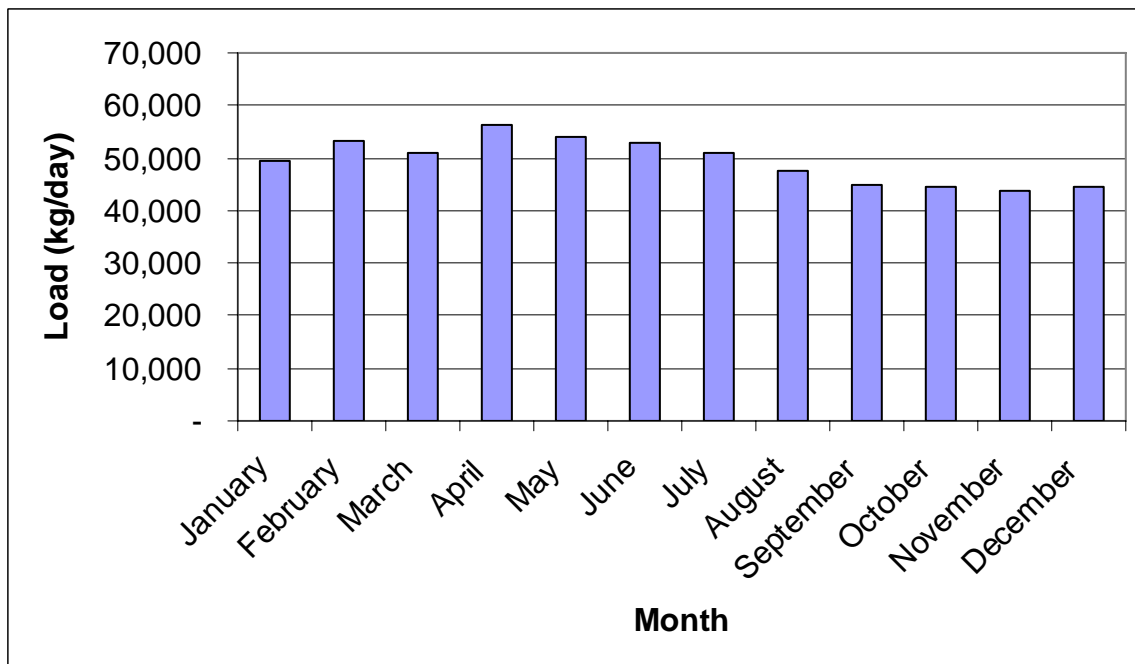


EXHIBIT 4.2.13: SWWTP Average Daily Influent CBOD Load by Month (1998-2003)

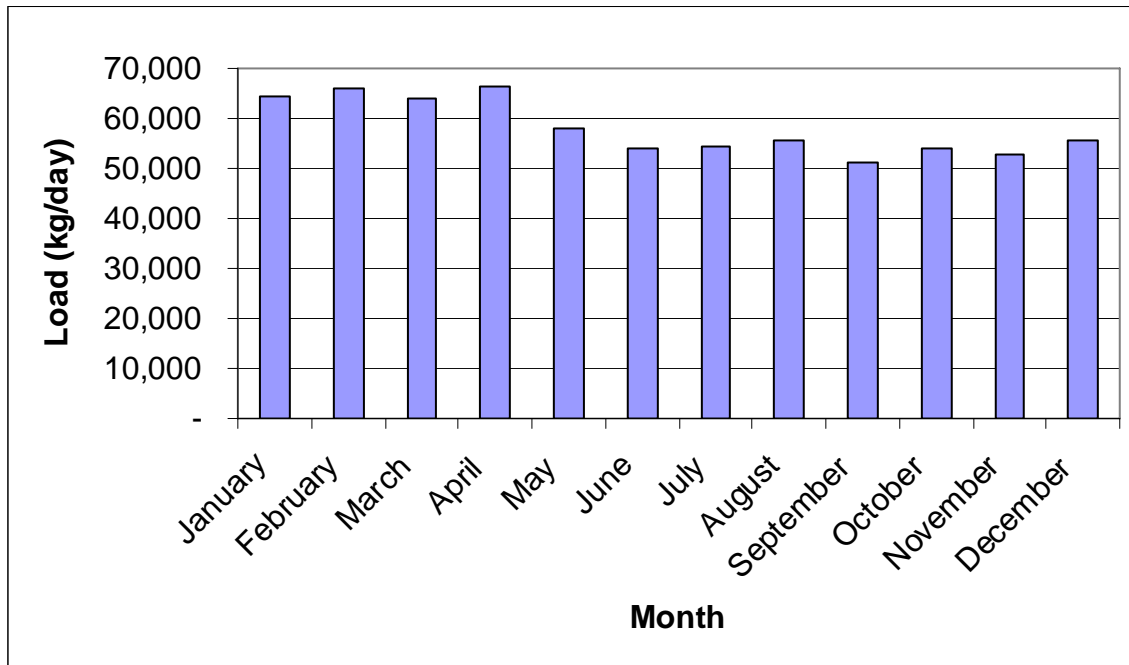


EXHIBIT 4.2.14: SWWTP Average Daily Influent NH₃ Load by Month (1998-2003)

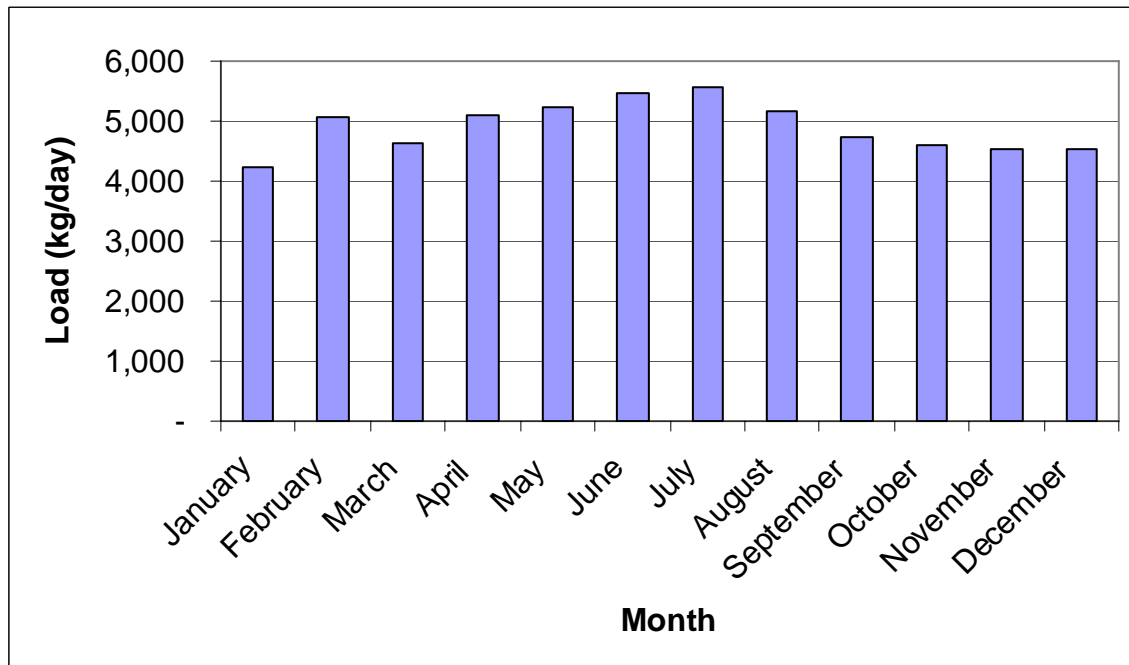
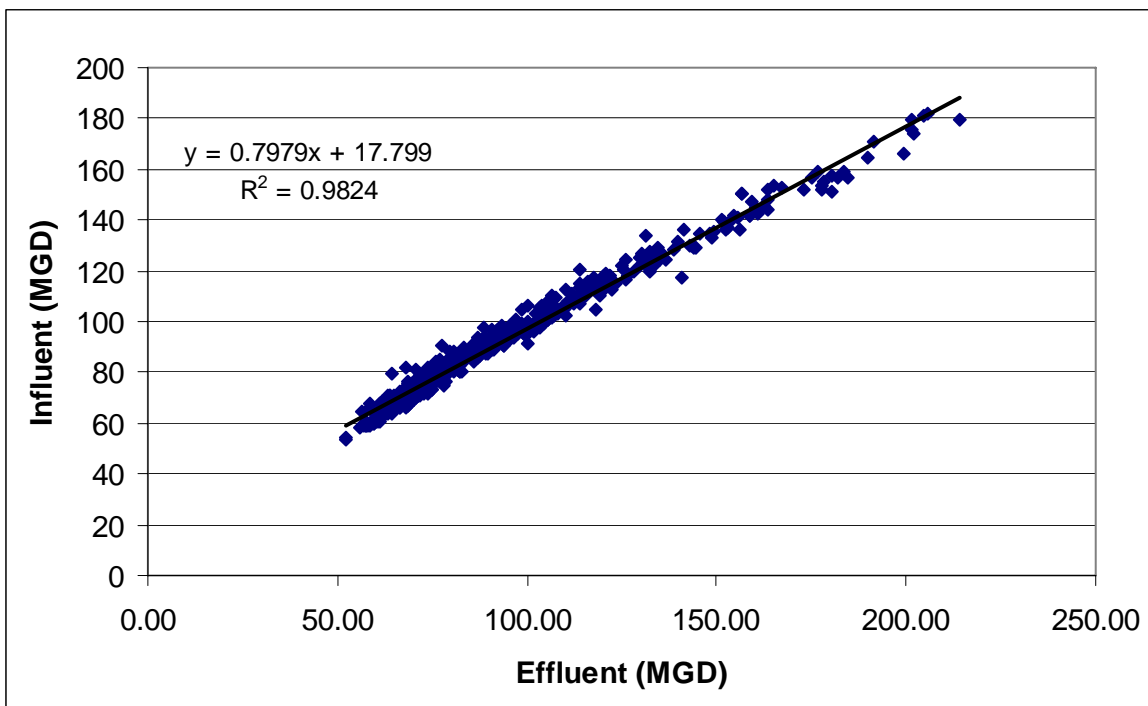


EXHIBIT 4.2.11 shows that for SWWTP, April tends to be the month with the highest flow rates while November sees the lowest flow rates. Stream stage levels are generally highest in March and lowest in September/October. This indicates that the flow in the sewers follows

the same pattern as the flow rate in the streams, although a little delayed. This is logical because trends in stream levels reflect the amount of precipitation received in the area. Elevated levels of precipitation would lead to increased flow rates in the combined sewer areas, which could be transferred to SWWTP by means of the Interconnector Sewer. Furthermore, stream levels also indicate trends in groundwater levels, and ground water levels impact the amount of flow arriving at the treatment plant due to infiltration effects. **EXHIBITS 4.2.12-4.2.14** show that although loads do vary by month, TSS, CBOD, and NH_3 do not follow the same pattern. TSS and CBOD tend to mimic flow rate, with higher loads around April and lower loads around September. NH_3 differs from this trend by having higher loads in July and lower loads in January. This is due in large part to the application of spring and summer fertilizers.

It should be noted that the SWWTP flow rate data, and thus the load data, were adjusted for accuracy. On September 2, 2002, SWWTP installed a new effluent flow meter. The flow measurements from this meter are more accurate than the measurements from the influent flow splitter, which was where the plant measured the flow rates it reported prior to September 2002. Thus, the influent flow rate data and the effluent flow rate data from September 2, 2002 through November 25, 2003 were plotted against each other, as shown in **EXHIBIT 4.2.15**.

EXHIBIT 4.2.15: SWWTP Influent Flow Rate vs. Effluent Flow Rate September 2, 2002 through November 25, 2003.



A linear trend line was fitted to the data with an $R^2=0.9824$. The trend line approximation quality is indicated by how close the R^2 value is to a value of 1. In this case the R^2 value indicates that the trend line is a good approximation of the actual relationship between the two flow rate values. The relationship indicates that the old flow rate measurements tended to over

report the low flow rate values and under report the high flow rate values. This relationship was then used to adjust the old flow rate values recorded by the influent flow splitter before September 1, 2002 to be consistent with the measurements taken by the effluent flow meter.

EXHIBITS 4.2.16-4.2.19 illustrate the daily flow rate and loading at JPWWTP from 1998-2003 by month.

EXHIBIT 4.2.16: JPWWTP Average Daily Flow Rate by Month (1998-2003)

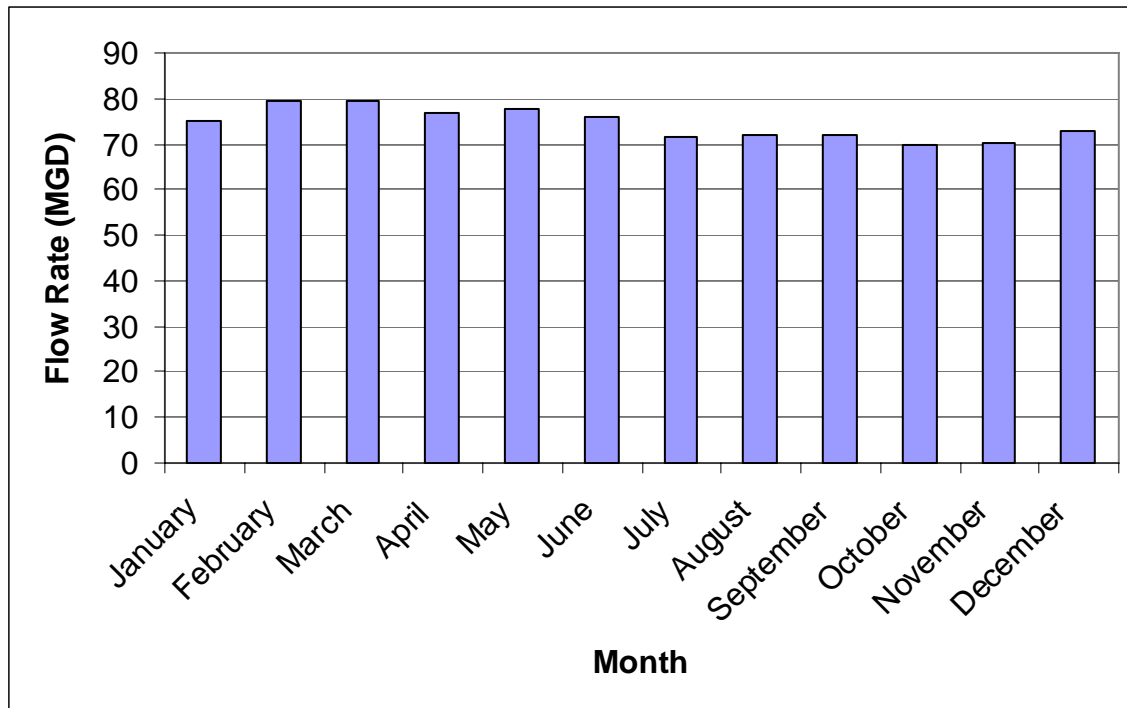


EXHIBIT 4.2.17: JPWWTP Average Daily Influent TSS Load by Month (1998-2003)

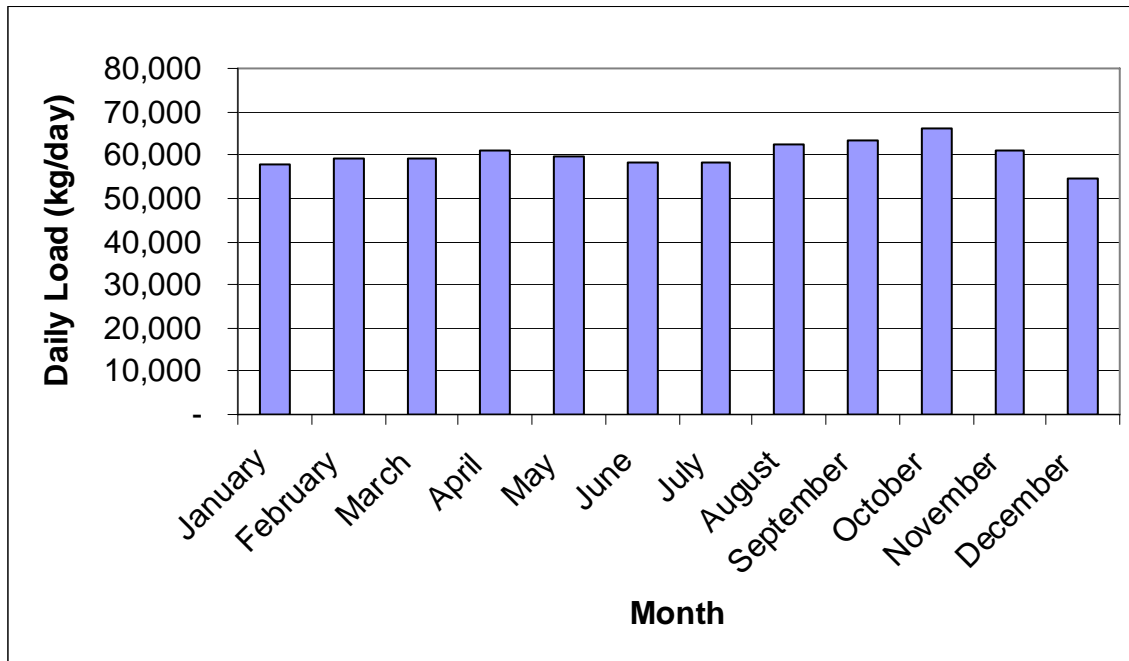


EXHIBIT 4.2.18: JPWWTP Average Daily Influent CBOD Load by Month (1998-2003)

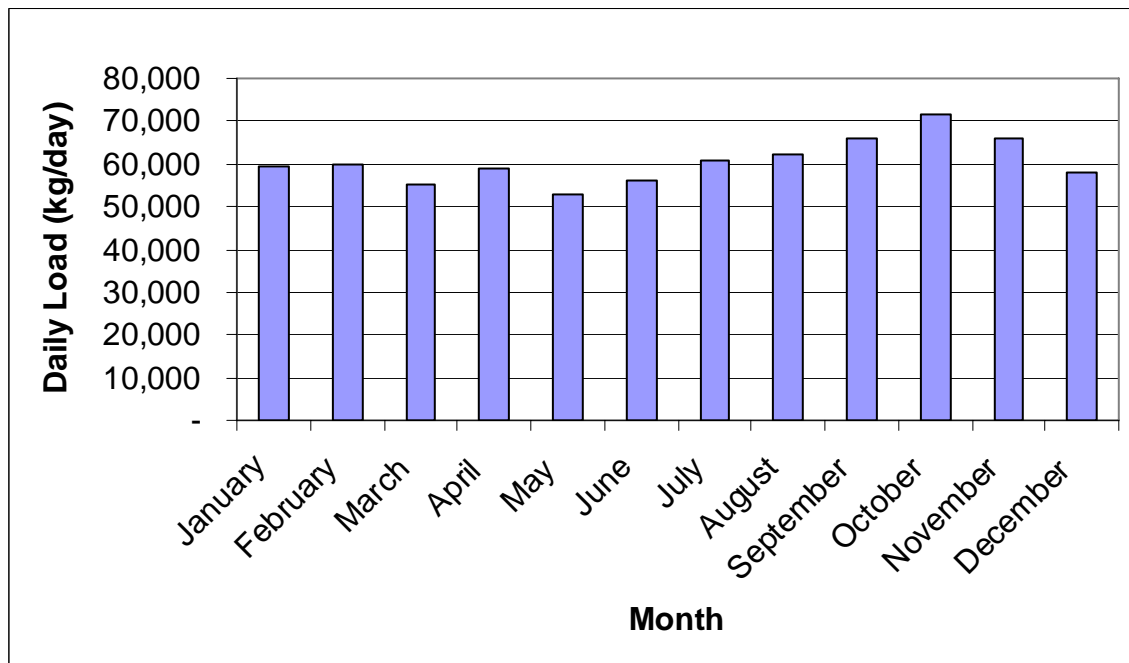
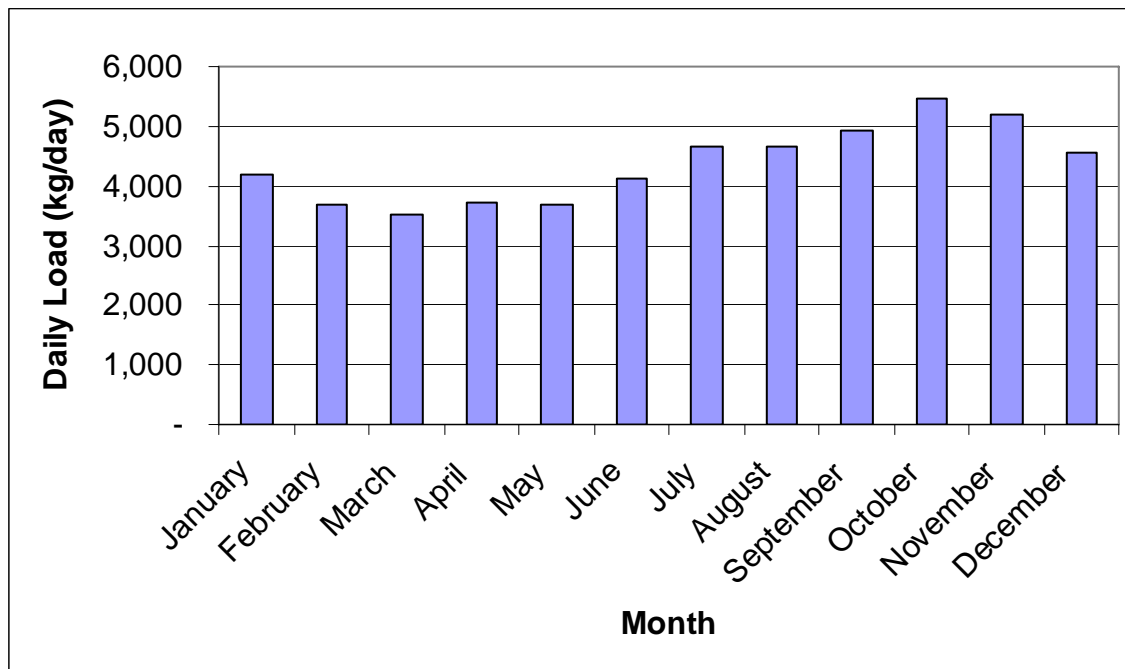


EXHIBIT 4.2.19: JPWWTP Average Daily Influent NH₃ Load by Month (1998-2003)



The influent flow rate data for JPWWTP tends to be more consistent throughout the year. Average flow rates at JPWWTP vary only 10 MGD between March and October while SWWTP has average flow rate values which vary 40 MGD between April and November. This seems logical due to the capability of JPWWTP to send flow to SWWTP via the Interconnector Sewer coupled with the greater peak capacity at SWWTP. The influent loads at JPWWTP shows a definite trend of higher loads in the fall around October and lower loads in the spring around March. This trend is evident in the CBOD and NH₃ data but less defined in the TSS data. The trend of seasonal variation in influent loads at JPWWTP is different than at SWWTP.

4.2.3.1 Wet-Weather vs. Dry-Weather Performance

The Columbus treatment plants experience different operating conditions during wet weather events than they do under normal dry weather conditions. To investigate the effect of these differences in performance, historic load data from 1998-2003 were examined to determine plant performance during both wet and dry weather conditions. To accomplish this, data were broken down into records which represented different ranges of precipitation. Plots were then developed showing average influent and effluent loads for a given range of precipitation values. **EXHIBITS 4.2.20-4.2.23** for SWWTP show load and plant flow for various levels of precipitation.

EXHIBIT 4.2.20: SWWTP Average Daily Plant Flow Rate versus Precipitation (1998-2003)

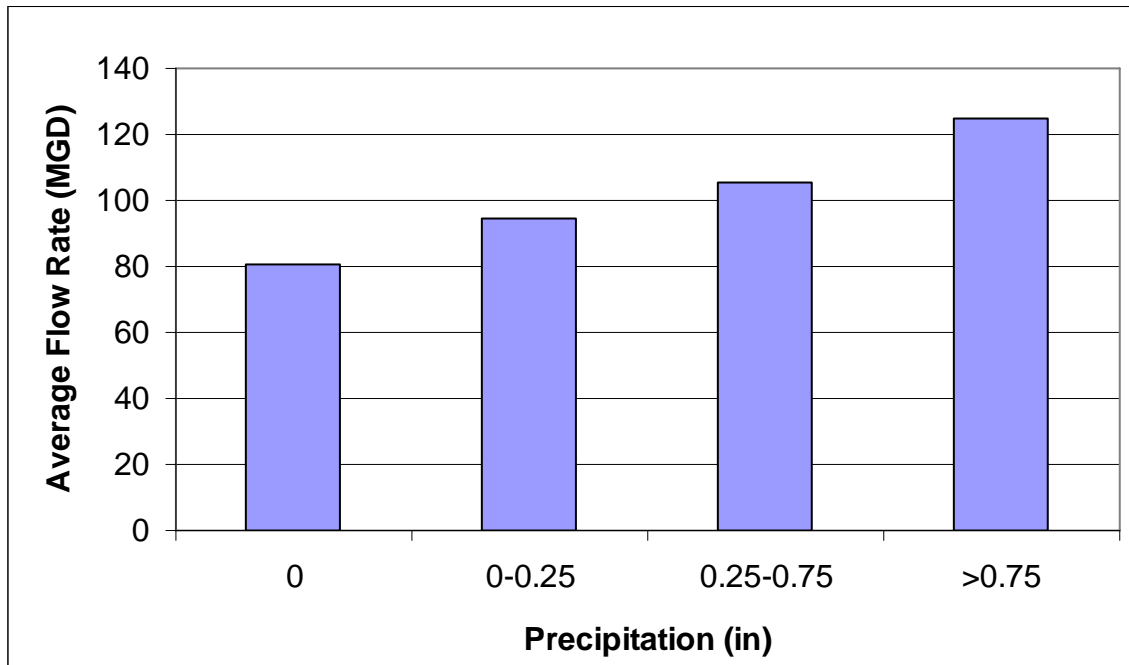


EXHIBIT 4.2.21: SWWTP Average Daily Influent TSS Load versus Precipitation (1998-2003)

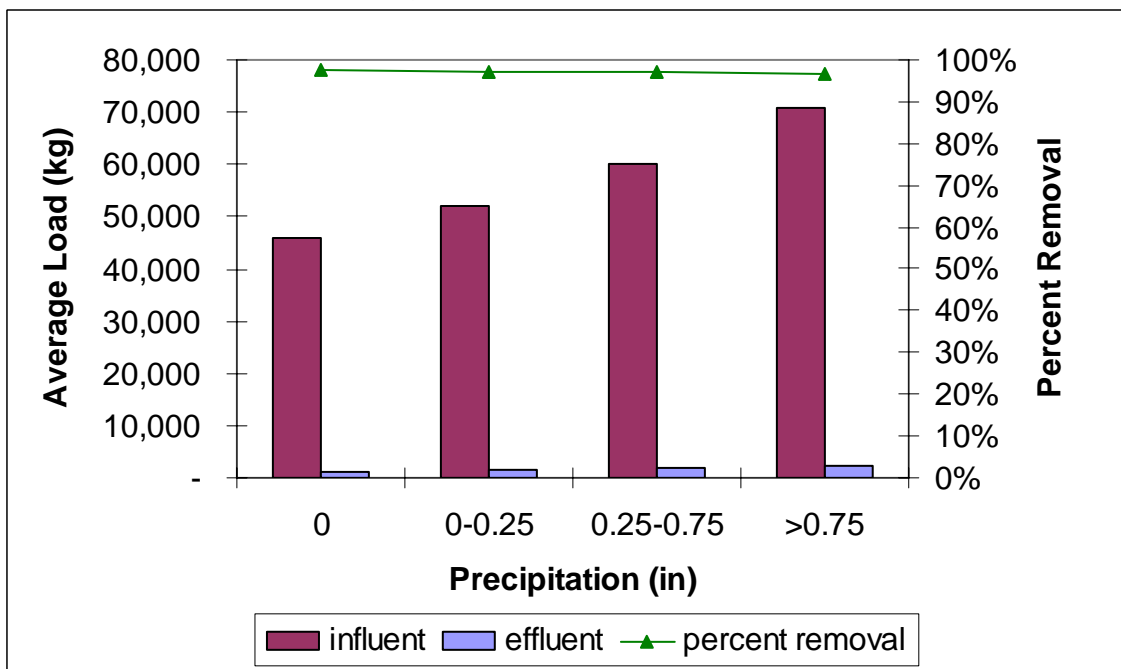


EXHIBIT 4.2.22: SWWTP Average Daily Influent CBOD Load versus Precipitation (1998-2003)

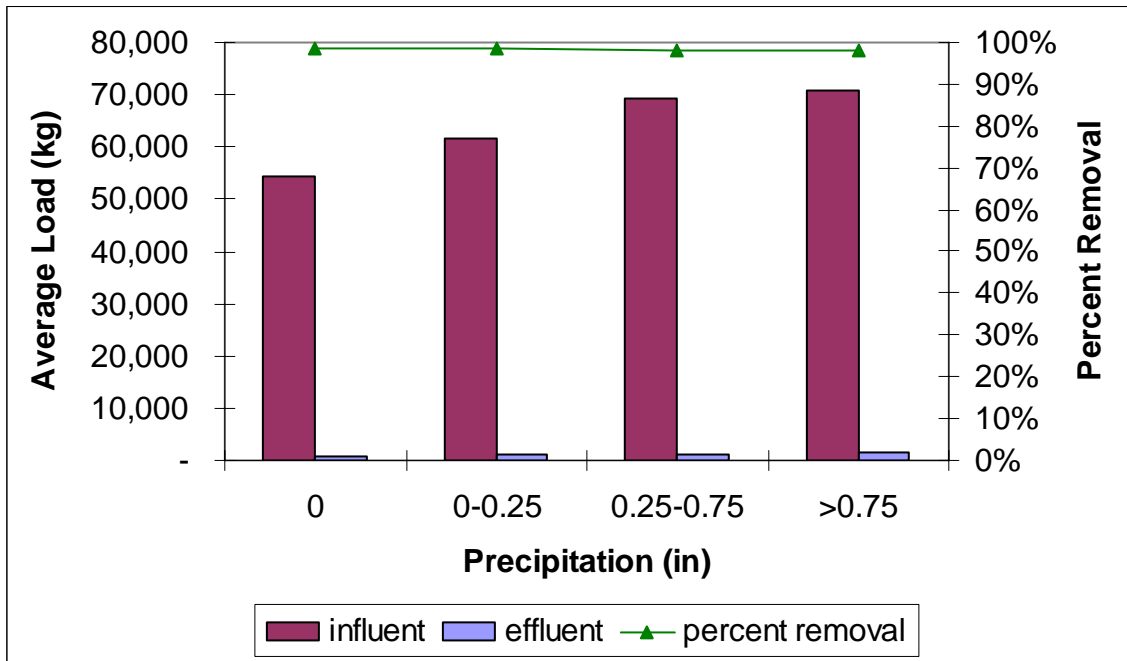


EXHIBIT 4.2.23: SWWTP Average Daily Influent NH₃ Load versus Precipitation (1998-2003)

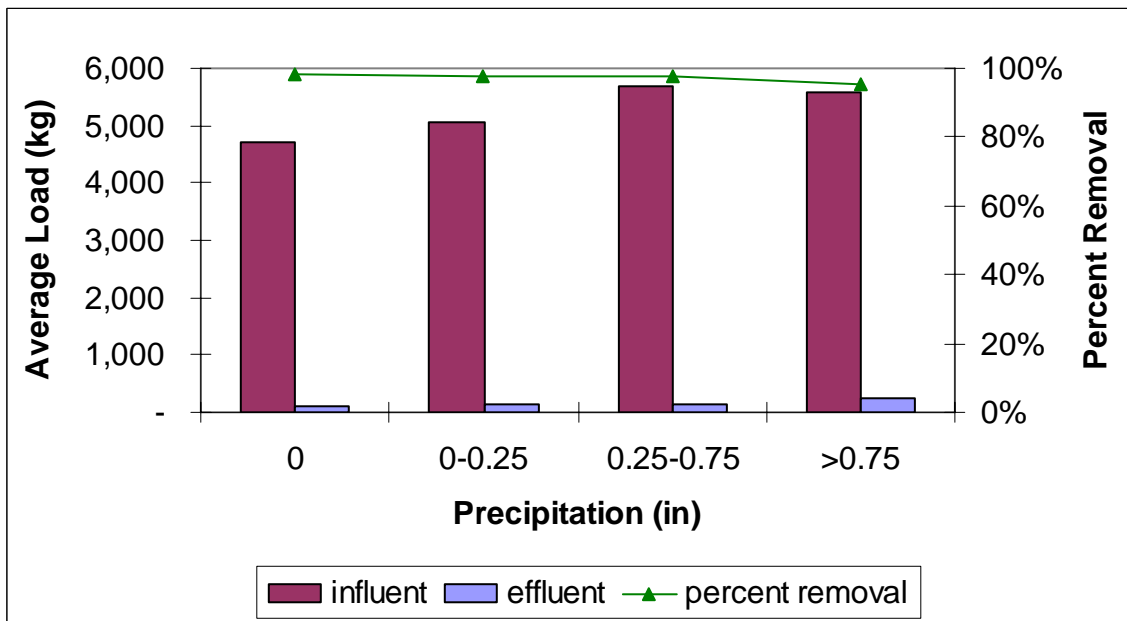


EXHIBIT 4.2.20 shows that plant flow rate also tends to increase as precipitation increases. Flow rate increases about 34% for days with >0.75 inches of precipitation compared to days with no recorded precipitation. **EXHIBITS 4.2.21-4.2.23** show that both influent load and effluent load increase as the amount of precipitation increases. Influent TSS increases the most, with the load on days with greater than 0.75 inches of precipitation almost 35% higher than the load on days with no recorded precipitation. CBOD and NH₃ had an increase of 23% and 16% respectively for days with greater than 0.75 inches of precipitation versus days with no recorded precipitation. Despite the increasing loads, the average percent removal remains fairly constant for TSS (97%) and CBOD (98%), while decreasing slightly for Ammonia (from 98 to 95.5%).

EXHIBITS 4.2.24-4.2.27 are for JPWWTP and show load and plant flow for various levels of precipitation.

EXHIBIT 4.2.24: JPWWTP Average Daily Plant Flow Rate versus Precipitation (1998-2003)

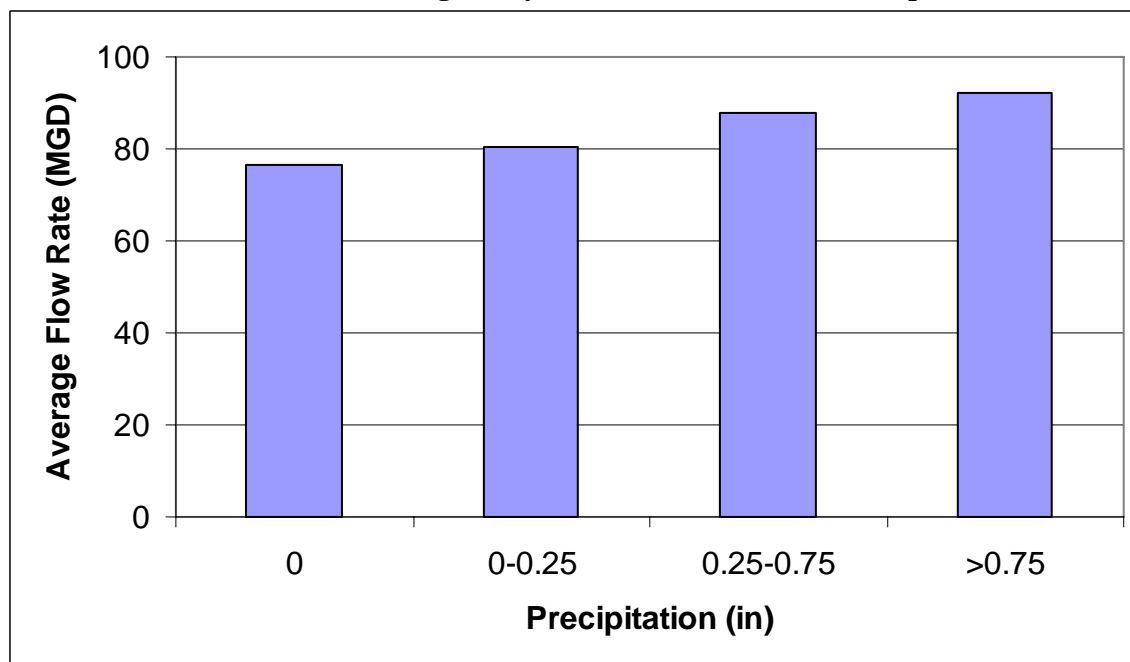


EXHIBIT 4.2.25: JPWWTP Average Daily Influent TSS Load versus Precipitation (1998-2003)

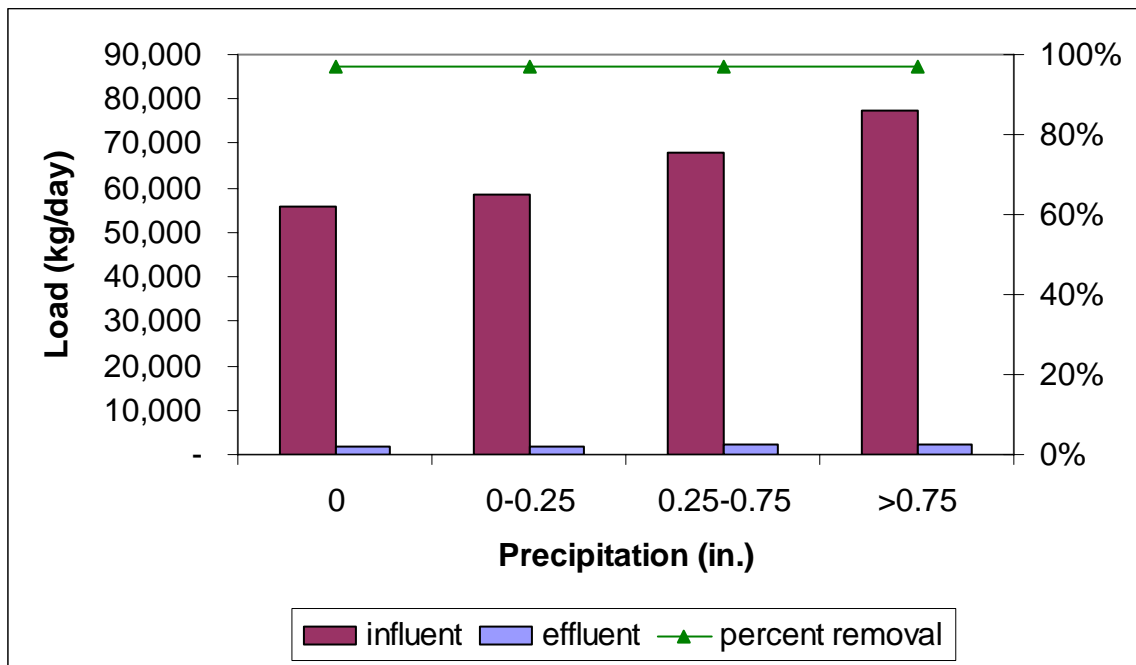


EXHIBIT 4.2.26: JPWWTP Average Daily Influent CBOD Load versus Precipitation (1998-2003)

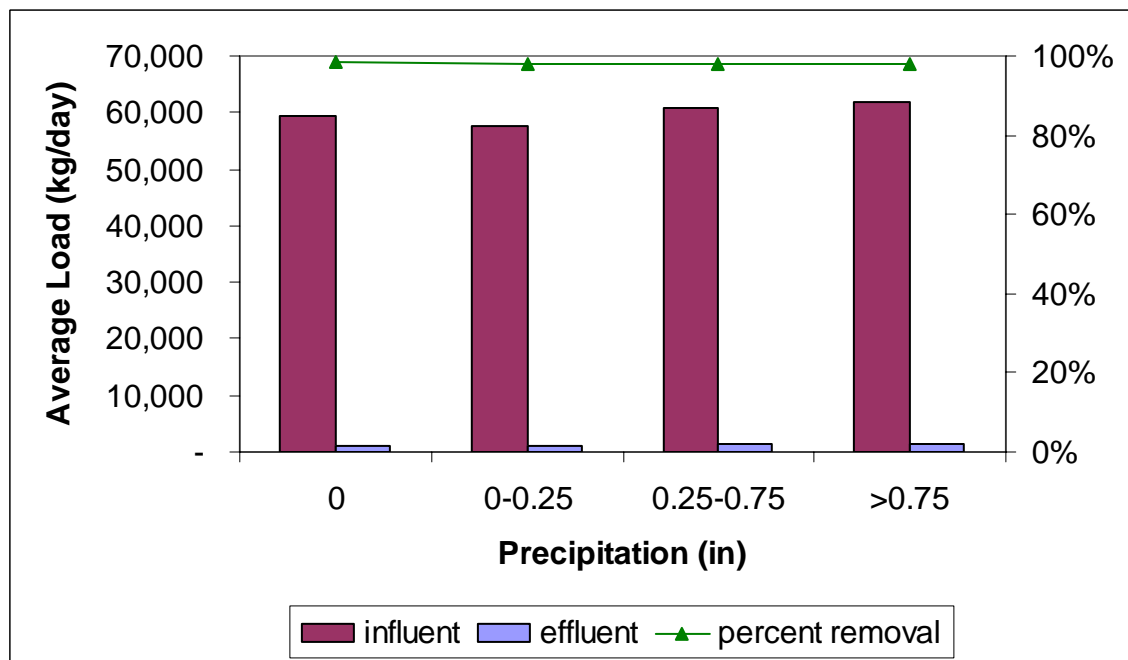


EXHIBIT 4.2.27: JPWWTP Average Daily Influent NH₃ Load versus Precipitation (1998-2003)

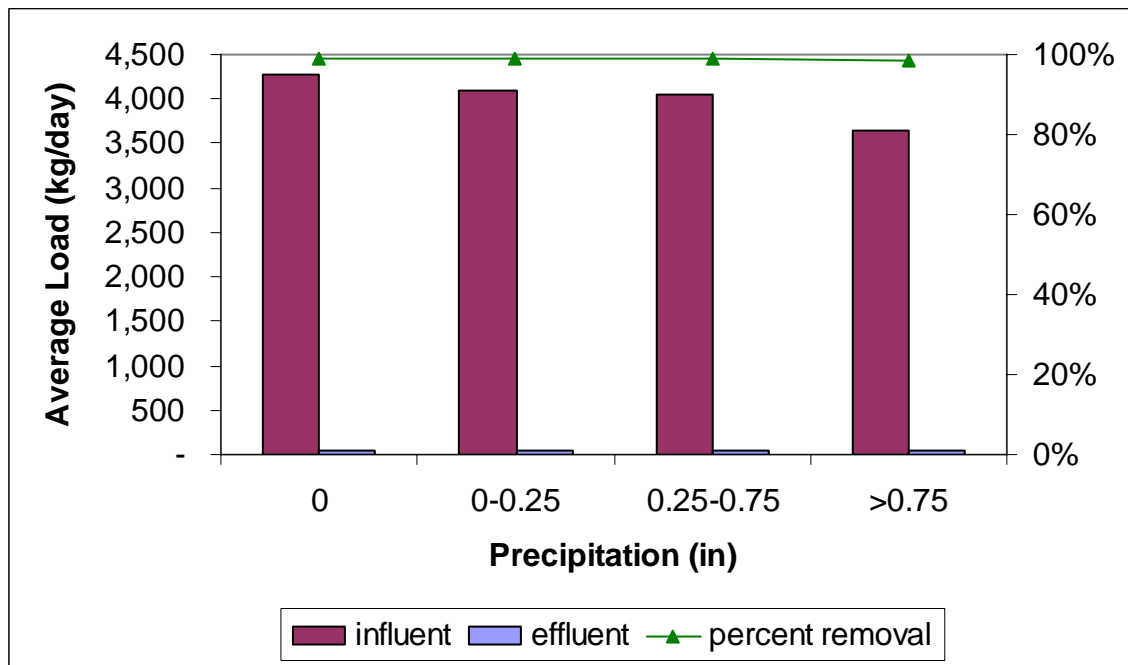


EXHIBIT 4.2.24 shows that plant flow rate tends to increase as precipitation increases. JPWWTP average flow rate increases about 16% for days with greater than 0.75 inches of precipitation compared to days with no recorded precipitation, which is about half the increase seen by SWWTP. **EXHIBITS 4.2.25-4.2.27** show influent load and effluent load for different levels of precipitation. Influent TSS load shows an increase with precipitation. The average influent TSS load on days with greater than 0.75 inches of precipitation was about 28% higher than the average influent TSS load on days with no recorded precipitation. Influent CBOD load was relatively constant, with no significant increase or decrease in average load as precipitation levels increases. Influent NH₃ data actually showed a 15% decrease in the load from days with no recorded precipitation to days with greater than 0.75 inches of precipitation. The consistent average loads for the different ranges of precipitation are likely because JPWWTP can send excess flow to SWWTP. The average percent removals achieved by JPWWTP changed very little between dry weather and wet weather days. In fact, the percent removals for TSS, CBOD, and NH₃ varied by less than 0.5% for all the precipitation ranges evaluated.

4.2.4 Foundation System (2009)

The foundation system is the existing sewer system including all projects planned to be implemented by 2009. Upgrades to the SWWTP Headworks are considered critical key improvements to the existing sewer system due to the substantial increase in wastewater pumping capacity. The construction of the SWWTP Headworks project is expected to be completed by 2009. Therefore, the Project Team has developed a Foundation System assuming operational completion of the headworks project by 2009. This system improvement is considered in the capacity and performance evaluation for this WWMP.

4.2.4.1 SWWTP Headworks Improvements

The need to upgrade the existing headworks facility is required because the facility has served its useful life of approximately 40 years and does not have sufficient hydraulic capacity for the influent flows received during wet weather. This results in frequent bypassing of raw sewage to the Scioto River.

The SWWTP headworks improvement project includes the construction of the Raw Sewage Pumping Station (RSP) building and the replacement of the existing 48-inch and 36-inch Interconnector Sewer force mains with a 102-inch gravity sanitary sewer, with provisions to build a second, parallel 102-inch sewer. Flows in each barrel could vary from 340 to 460 MGD varying on the head conditions upstream and downstream. In addition, it is proposed to install an influent in-line flow storage control and four mechanical self cleaning bar racks. The racks will protect the raw sewage pumps from large debris. The proposed pump station will include two wet wells, two dry wells and four raw sewage pumps with space available for two additional pumps. Grit and scum accumulation is anticipated in the wet well because the pumps will be located before the screening and grit removal facilities. To minimize odors, corrosion problems and maintenance costs resulting from grit and scum accumulation, it is proposed to construct self cleaning trench type wells. This well design will include the construction of a spillway, called the “ogee spillway,” near the intake of the pumps at the bottom of the wet well. The ogee spillway will allow the wet well to be cleaned by periodically performing a pumping cleaning cycle.

Under later phases of the SWWTP improvements, a new Screen and Grit building (SGB) will be constructed to receive influent flows from the RSP. The SGB will contain new perforated panels (punched plate) screens and vortex type grit removal systems. New grit tank conduits will be constructed to convey the SGB effluent into the existing Influent Flow Splitter (IFS). In addition, a new Odor Control Facility (OCF) will be constructed to handle odors from new headworks. A smaller odor control unit will be added at the IFS. Finally, the new main drain for the plant will be constructed and tied into the influent box of the RSP.

The new SGB is designed to receive flow from the RSP via four 54-inch raw sewage pump discharge lines. The building design provides four screens and four grit tanks for receiving flow. Finally, the proposed SGB will include a post-screening 108-inch wet weather bypass conduit control gate. The bypass channel will be equipped with a Parshall flume.

The new SWWTP headworks are designed to increase the influent flow capacity from 185 MGD to an initial capacity of 330 MGD and an ultimate capacity of 660 MGD.

4.2.5 Operational Strategies

The system operation strategy provides the necessary uniform management for the key controls in the system to collect and treat both the sanitary DWF and WWF. The system operational strategy during the DWF ensures full secondary treatment of DWF. Existing collection system and treatment capacity are adequate to fully handle DWF conditions.

For WWF conditions, the operational strategy regulates both the combined and separate sewer facilities to ensure maximum treatment of separate and combined WWF. The following objectives guide the separate sanitary system operational strategy during WWF conditions:

- Maximize treatment at both wastewater treatment plants: Jackson Pike Wastewater Treatment Plant (JPWWTP) and Southerly Wastewater Treatment Plant (SWWTP).
- Maximize storage in all system components to avoid any overflows or bypasses.
- Avoid any possible activation of JPWWTP or SWWTP bypasses.
- Avoid any SSO activation.
- Avoid any CSO activation

In addition, the following objectives guide the combined system operation strategy:

- Direct the first flush to the plants for full treatment.
- Based on the conditions at JPWWTP and SWWTP and the priority to utilize their capacity in treating separate wet weather flow, the combined system could completely be segregated from the separate sanitary system. The separate sanitary flow would be preferentially directed to the treatment plant, while excess flow which needed to be directed to the receiving waters would come from the combined system.
- Similarly, if the combined flows at the CSO regulators exceed the capacity of the regulators, the regulators can overflow to the receiving waters.

All manholes along the BWARI trunk sewer are sealed with no overflow. The maximum allowable surcharge elevation will range from 680 feet in the vicinity of the new Southerly WWTP (to avoid possible 002 bypass at 681 feet elevation) to 700 feet, upstream of SWWTP, at the cross connection between BWARI and Big Walnut Outfall (to avoid surcharge in the BWO). BWARI is thus also used as a storage facility.

There are 39 key control structures whose operational strategies would impact the flow dynamics in the collection system. These key components are grouped in three categories: key components within the combined system with major effect on the combined sewer overflow; key components affecting the separate system; and the headworks at Jackson Pike WWTP and Southerly WWTP. TABLE 4.2.2 lists settings of key components in the combined sewer system for Existing and Foundation systems. TABLE 4.2.3 lists settings of key components in the separate sewer system for Existing and Foundation systems. TABLE 4.2.4 lists settings of key components at the headworks facilities for Jackson Pike and Southerly WWTPs for Existing and Foundation systems.

4.2.5.1 Existing System (2005)

The above system operational strategy in 2005 follows the operation plan detailed in the City of Columbus Revised 2005 Interconnector Sewer Operation Plan (IISOP), which is under revision and will be submitted by the City to the Ohio EPA. The IISOP provides for the necessary uniform combined sewer overflow control and separate sanitary sewer overflow control. The IISOP better manages the interior drainage features added to the system as part of the West Columbus Local Protection Project (WCLPP). Major components of the IISOP are described as:

- Dodge Park Combined Pump Station: A new pump-station facility that will intercept the combined sewage area west of the Scioto River and discharge into the OSIS upstream Whittier Tanks.
- Scioto Main Flow Control Structure (SCMFCS): A new SCMFCS with 1 sluice gate and 2 knife gates that will allow for storage in the Scioto Main Interceptor (SCM) by controlling the flow from the SCMFCS at a maximum of 60 MGD.
- Emergency Bypass to the Scioto River at McKinley Ave. (to be activated when the Scioto River reaches a 25-year stage.
- Scioto Main Replacement Sewer (SCMR): Flows from SCM, West Side Sanitary Sewer (WSS), and West Side Relief Sewer (WSR) are combined in a new junction chamber and routed south to discharge at the new Flow Diversion Structure (FDS) upstream from JPWWTP to provide preferential treatment to the separate sanitary flows.
- Renick Run Overflows Removal: All overflows to the Renick Run storm sewer have been removed. This includes overflows from SCM, WSS, and WSR.
- Remove Cozzins Street Regulator (scheduled for removal in 2005).

Another consideration affecting the system operation includes the segments of the main interceptors that may surcharge but would not cause backup effects or a water in basement condition. The City has sealed or raised manholes along these segments, or the manholes are special pressurized types. All manholes along the following trunk sewers are considered sealed with no overflows:

- Interconnector Sanitary Sewer (INT): Maximum allowable elevation is 702 feet at Grant Run to avoid backup effects on Grove City served area.
- OSIS south of Whittier Control House to JPWWTP: Maximum allowable surcharge elevation is controlled by the DSR083 overflow elevation of 697.1 feet. Surcharge elevation in other locations along this segment is also controlled by the Greenlawn Avenue sewers to be less than 698.85 feet.
- Big Run Sanitary Trunk Sewer (BRN) in the vicinity of JPWWTP: Maximum allowable surcharge elevation is 708 feet, which is affected by the served area on Hardy Parkway.
- Big Walnut Trunk Sewer: manholes raised to be above the 100 year floodplain.
- Alum Creek Trunk Sewer: manholes raised to be above the 100 year floodplain.

- Blacklick Trunk Sewer: manholes raised to be above the 100 year floodplain.

In accordance with the IISOP, the normal DWF operation condition includes:

- Operate the Headwork at JPWWTP up to maximum treatment to maintain the influent wet well elevation between 8 and 12 feet.
- If the JPWWTP wet well elevation cannot be maintained at 12 feet, divert excess flow to SWWTP through the Flow Control Structure (FCS) and the Interconnector Sewer.
- Maintain the Interconnector Pump Station (IPS) wet well elevation at 8 feet.
- Control the SWWTP treatment rate to maintain the SWWTP wet well elevation at 7 feet.

The IISOP for the WWF condition is as follows:

- Open the FCS gate to use the Interconnector Sewer for storage and allow the IPS wet well elevation to reach up to 16 feet. If this depth is reached, throttle the FCS gate to allow the maximum of 60 MDG to be diverted from JPWWTP to SWWTP.
- Start throttling the Regulator gate in the Whittier Street Storm Tank (WSST) Control House and allow excess flow to start diverting to the WSST.
- If the JPWWTP wet well elevation can no longer be maintained at or below 12 feet, completely close the regulator gate at WSST. This will allow for JPWWTP and SWWTP to be fully utilized for separate sanitary secondary treatment. The combined flow will fill the WSST before overflowing to the receiving water at Scioto River.
- Maintain the OSIS elevation upstream of the WSST Control House at a maximum of 710 feet by opening the Emergency Bypass gates in the Control House.

The IISOP details the sequence of bypass activities when flow can no longer be maintained in the system. The four possible locations are bypass 002 at SWWTP, DSR083 at Deshler Tunnel/Franklin Main overflow, mechanical and hydraulic bypass at JPWWTP, and the emergency bypass (DSR#399) on the Scioto Main Interceptor Sewer when the Scioto River elevation reaches the 25-year stage.

4.2.5.2 Foundation System (2009)

Additional CIPs scheduled for construction by 2009 that have a major impact on the operational activities of the collection system are added to reflect the Foundation (2009) System, which include the:

- Hiawatha Relief Sewer: As part of the Maize/Morse I/I study, a new Hiawatha Relief Sewer will help to mitigate the sanitary sewer overflows in the study area. The sewer discharges into Iuka Ravine Sewer.
- Driving Park CIPs: Two CIPs were identified as part of the Driving Park I/I study. They will replace existing undersized pipes to relieve sewers in the Driving Park area that discharge to the Alum Creek Interceptor Sewer (Deshler Tunnel).

- Blacklick Augmentation: A new 72-inch sewer parallel to the existing 48-inch Blacklick Sewer relieves the downstream portion of the BLC sewer.
- Big Walnut Augmentation\Rickenbacker Interceptor (BWARI): The Rickenbacker Interceptor will be serving the southeast tributary area of the City of Columbus. The two trunks, BWARI and Big Walnut Outfall Sewer (BWO), will be connected through a special diversion chamber that allows BWO to relieve into the BWARI based on the system operation needs.
- Interconnector Pump Station Removal (IPS): A new Interconnector gravity line (two pipes west of the river and one 104-inch pipe east of the river) will convey flows from the Interconnector to the new influent junction chamber upstream of the new SWWTP headworks.
- New SWWTP Headworks: the headworks at the SWWTP based on the City of Columbus growth pattern. The new physical structure will combine flows from the BWARI, BWO, and the Interconnector Sewer to a new influent junction chamber.
- OSIS Grit Chamber Removal: The grit chamber located along the OSIS downstream of the Whittier Street Control House will be removed. The grit chamber gates will no longer be used for operation activities of the OSIS. As of May 2005, the grit tanks are no longer used for grit removal.

4.3 Receiving Waters

The purpose of this section of the characterization report is to provide a general characterization of not only the surface waters in the Columbus wet weather management planning area that receive and transport any discharges from the existing Columbus Combined Sewer System (CSS) but also the surface waters that are upstream of any existing CSS discharge points. To do so, this section identifies the present physical, chemical, and biological conditions of the planning area surface waters as well as some of the special attributes of those waters. **SECTION 4.1** contains the data and information regarding the tributary population and the tributary sanitary sewer system type and service area to the surface waters discussed herein.

This section will discuss bacterial results from the water quality sampling. The bacteria WQS is a two part standard. One part of the standard for bacteria is based upon the geometric mean of a set of sample values taken in a 30-day period, and therefore a single sample value cannot be said to either exceed or not exceed the water quality standards. However, the value of a single sample does contribute to the geometric mean outcome, and an elevated single value can be said to be of “concern” due to its possible contribution to a 30-day geometric mean exceedance. This is the terminology that will be used in this section to characterize individual bacterial values in relationship to the geometric mean standard.

The second part of the standard for bacteria is based upon a maximum value that cannot be exceeded in more than 10% of the samples in a 30-day period. A single sample, in this part of the standard, can be said to exceed the allowable maximum value, although the standard itself is not necessarily exceeded.

It should also be noted that much of the water quality sampling was intentionally conducted during periods that were expected to result in high bacterial values (wet weather); no representative statistical conclusions concerning water quality exceedances can be drawn from aggregations of these particular data since the sampling was intentionally not representative. Rather, the importance of such data lies in their contribution to the calibration of the receiving stream water quality model. It is the receiving stream water quality model that will be used to evaluate the potential for bacterial water quality exceedances for the various plan alternatives.

4.3.1 2003 – 2004 Water Quality Baseline Data

The receiving waters characterization is based on the summarization of more than 3 million metering and sampling data points that comprise the water quality baseline data for the characterization. Collected in the fall of 2003 and the summer and fall of 2004, the water quality baseline data is used for the characterization of receiving waters and for the data needed in the construction of a water quality model.

The 2003 - 2004 water quality baseline data is contained in the following Wet Weather Management Plan appendices:

- **APPENDIX E** serves as the reference for all long-term combined sewer overflow (CSO) control plan data collected using continuous metering equipment during: 1) September and October 2003; and 2) between April and November 2004
- **APPENDIX F** serves as the reference for all long-term CSO control plan data collected using discrete metering equipment and water quality sampling: 1) during September and October 2003; and 2) between April and November 2004

The operation of the continuous and discrete metering equipment was concurrent with dry weather and wet weather discrete metering and water quality sampling. The sampling was performed as identified in the Quality Assurance Project Plan (QAPP) contained in **APPENDIX C**. The QAPP also identifies the procedures used in determining a dry weather event and a wet weather event.

TABLE 4.3.1 lists the dry weather and wet weather water quality sampling events completed as part of the water quality baseline data collection activities.

The receiving waters characterization also uses pertinent data and information from **APPENDIX D**.

4.3.2 Characterization of Existing Receiving Waters

4.3.2.1 Introduction

For purposes of this report, 32 metering and sampling zones are defined. The 32 zones are contained in nine separate surface waters area delineations. The delineations are the Upper Olentangy River, the Lower Olentangy River, the Scioto-Downtown, the Scioto-South Columbus, the Upper Alum Creek, the Lower Alum Creek, the Three Rivers, the Scioto-Big Walnut and the Scioto-Little Walnut surface water areas. All nine surface water body areas lie within the downstream portion of the Upper Scioto River basin as defined by the Hydrologic Unit Code 0506 established by the U.S. Department of Agriculture, Natural Resources Conservation Service.

The 32 metering and sampling zones were selected using the following criteria:

- Locations upstream, downstream and within of the existing combined sewer system (CSS)
- Locations given the three following types of existing physical conditions of the receiving waters:
 - Free flow conditions in relatively natural streambeds
 - Free flow conditions in manmade channels
 - Free flow restricted conditions in manmade impoundments

The nine surface waters area delineations and the 32 metering and sampling zones in the nine areas are as follows:

- **Upper Olentangy Surface Water Area** – Wilson Bridge Road, State Route 161 and Henderson Road zones

- **Lower Olentangy Surface Water Area** – Dodridge Street, John Herrick Drive, Fifth Avenue and Goodale Avenue zones
- **Scioto-Downtown Surface Water Area** – State Route 33 (Olentangy River), Souder Avenue, Broad Street, Main Street, Town Street, I-70 and Greenlawn Avenue zones
- **Scioto-South Columbus Surface Water Area** – State Route 104, Jackson Pike and I 270 zones
- **Upper Alum Creek Surface Water Area** – Cleveland Avenue, State Route 3 and Mock Road zones
- **Lower Alum Creek Surface Water Area** – Main Street and Livingston Avenue zones
- **Three Rivers Surface Water Area** - State Route 104 (Alum Creek), Williams Road (Alum Creek), Winchester Pike (Blacklick Creek) Williams Road (Big Walnut Creek) and Reese Road (Big Walnut Creek) zones
- **Scioto-Big Walnut Confluence Surface Area** - Rowe Road (Big Walnut Creek), State Route 665 and State Route 762 zones
- **Scioto-Little Walnut Confluence Surface Area** – State Route 316 and Commercial Point Road zones

These nine surface water body area delineations are shown in **FIGURE 4.3.1**.

This section will discuss bacteria results from water quality sampling, but it will not make any conclusions about exceedances of standards. Bacteria standards are designed as values which should not be exceeded by a 30 day average. The bacteria samples discussed here were intentionally taken during periods which see elevated bacteria concentrations. Thus, a statistical analysis of these samples would not be representative of an actual 30 day average.

4.3.2.2 Physical Characteristics of the Receiving Waters

This section describes the 2003 - 2004 physical conditions of the surface waters in the WWMP planning area. Besides such items as setting, geology, soils, riparian zones and flood plains, this section incorporates a Qualitative Habitat Evaluation Index (QHEI) associated with the metering and sampling sites as part of the physical characteristics of the streambeds. The qualitative habitat evaluation is the primary tool presently used in Ohio to relate the physical conditions of a streambed, the fish assemblages likely supportable by the streambed and the State of Ohio Water Quality Standards (Ohio WQS) for fish communities.

The following identifies the 2003 – 2004 physical characteristics of the Scioto River, the Olentangy River, Big Walnut Creek, Alum Creek, and Blacklick Creek in the WWMP planning area as well as in and downstream of the CSS.

- **Common Physical Characteristics**

- **Geology:**

- While both the Illinoisan and Wisconsin glacial periods influenced land forms, soil types and stream substrates in the WWMP planning area, the Wisconsin glacial

period appears to have had a greater influence in generating the current physical conditions. The last advance of the Wisconsin glacial period into the Wet Weather Management Plan (WWMP) planning area occurred about 16,000 years ago.

The rolling topography of the WWMP planning area is a result of the till plains, and ground and terminal moraines deposited by the Wisconsin glacial period. These till plains and moraines overlie sedimentary bedrock. The sedimentary bedrock consists primarily of dolomitic limestone, shale and sandstone.

Natural stream substrate reflects both the glacial deposition materials and the bedrock materials. Limestone, sandstone and shale are the predominant substrate constituents.

■ **Ecoregion:**

With the WWMP planning area, the surface waters are within the Loamy High Lime Till Plains of the Eastern Corn Belt ecoregion. The Eastern Corn Belt ecoregion is characterized by level to rolling glacial till plains, ground moraines, end moraines and glacial outwash features drained by low gradient streams. The smaller streams in this ecoregion are channelized to assist in soil drainage.

■ **Soils:**

FIGURE: 4.3.2 shows the ten soil associations¹ present in the WWMP planning area. Soils within the WWMP planning area are derived from loamy, limey glacial deposits and from the interaction of bedrock geology, climate, slope-topography, flora, fauna, and the passage of time since the Wisconsin glacial period.

As observable from **FIGURE: 4.3.2**, the following six soil associations are the most frequently encountered soil associations along the surface waters that could be possibly impacted by the CSS:

- The Medway-Genesee-Sloan association is the dominant association in the narrow flood plains of the WWMP planning area surface waters near and downstream of the confluence of the Olentangy River and the Scioto River and near and downstream of the confluence of the Alum Creek, Big Walnut Creek and Blacklick Creek. The Medway soils occur in broad areas of the flood plain. Narrow strips of Genesee soil are seen adjacent to streams while the Sloan soils are encountered in depressions. Each of these soils has a silt loam surface layer and high available water capacity.
- The Eldean-Ockley-Warsaw association is dominant association adjacent to the flood plains near and downstream of the confluence of the Olentangy River and the Scioto River and near and downstream of the confluence of the Alum Creek, Big Walnut Creek and Blacklick Creek. Eldean soils commonly occur on kames, slope breaks, and slightly elevated droughty flats and have low to moderate available water capacity. Ockley and Warsaw soils are on

¹ McLoda, N.A., and Parkinson, R.J., 1980. *Soil Survey of Franklin County, Ohio*. Soil Conservation Service, US Department of Agriculture. Columbus, Ohio.

broad flats and slightly undulating areas that are not as droughty. Ockley soils have moderate to high available water capacity. Warsaw soils have moderate available water capacity. All of these soils have a silt loam surface layer.

- The Miamian–Celina association is the dominant association in a narrow band along the west of the upper Olentangy River and lower Scioto River. Miamian soils are on the higher knolls and the sides of ridges and valleys with a silt loam, clayey silt loam or a clay loam surface layer. Celina soils are on broad ridge tops and low knolls with a silt loam surface layer. Miamian soils have low to moderate available water capacity. Celina soils have moderate available water capacity.
- The Cardington-Alexandria-Bennington association is the dominant association in the flood plain along portions of Alum Creek, Big Walnut Creek and Blacklick Creek. Cardington soils commonly occur on knolls and ridges. Alexandria soils commonly occur on hillsides and side slopes. Bennington soils commonly occur on foot slopes and ridge tops. All these soils have moderate available water capacity and a silt loam surface layer.
- The Bennington-Pewamo association is the dominant association in northeastern Franklin County. The Bennington soils commonly occur on flats, low knolls and ridges. Pewamo soils commonly occur in depressions and concave parts of the landscape. All these soils have a silt loam surface layer and high available water capacity.
- The Crosby-Kokomo-Celina association is the dominant association in southeastern Franklin County. Crosby soils commonly occur on flats and low knolls. Kokomo soils commonly occur in depressions. Celina soils commonly occur on knolls, ridges and side slopes along surface waters. Crosby soils have a silt loam surface layer and moderate available water capacity. Kokomo soils have a silty clay loam surface layer and high available water capacity. Celina soils have a silt loam surface layer and moderate available water capacity.

TABLE 4.3.2 identifies the K values for these soils within the receiving waters characterization area. The K factor is one measure of soil erosion potential, one of six used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The K factor takes into account soil structure, permeability and the percentage of silt, sand and organic matter. The values of K range from 0.05 to 069. The higher the value the more susceptible is the soil to sheet and rill erosion.

Though the primary source of sediment to the Scioto watershed is agricultural cropland, the rapid pace of land use change and highway expansion in and upstream of the WWMP planning area could lead to an increased contribution from sediment load finding its way to the Scioto watershed from residential, commercial and transportation construction sites surface runoff. Although development in Delaware County, especially in the township areas immediately upstream of the WWMP planning area is expected to slow over the WWMP planning period, it is currently among the most rapid in Ohio. Additionally, development within Franklin County is also significant in currently

undeveloped areas as identified in the sanitary sewer system characterization section exhibits for the developed land and developable land serviceable by the Columbus sanitary sewer system service area. Most of the expected development in and adjacent to the WWMP planning area will be tributary to freely flowing sections of the WWMP surface waters. Urban storm drainage system regulations and policies that limit the amount and rate of runoff from developing land to the amounts and rates of the undeveloped land should mitigate any increase the peak flow hydraulics of the WWMP surface waters as planned growth occurs and any concurrent changes in sediment loading.

■ **Individual Physical Characteristics of the Scioto River**

■ **Setting:**

The 235-mile long Scioto River originates in Hardin County at an elevation of 1010 feet mean sea level (msl) and has a total drainage area of approximately 6520 square miles at its confluence with the Ohio River at an elevation of approximately 474 feet msl. From its origin, the river flows across 31 central and southern Ohio counties.

The portion of the river within WWMP planning area is approximately 48 miles long. The WWMP planning area includes approximately 280 square miles of drainage within the 6517 square miles of the Upper Scioto River Basin.

The portion of the river in and downstream of the existing CSS is approximately the lower 19 river miles of the river. The length of the surface waters affected by the existing CSS begins near River Mile 132 below the Dublin Road Dam in central Columbus at an approximate elevation of 702 feet msl and ends at the downstream WWMP planning area boundary near River Mile 101 at Commercial Point Road approximately 1 river mile upstream of the Big Darby Creek confluence at an approximate elevation of 691 feet msl.

Two major water supply impoundments upstream of the existing CSS planning area and three low head dams within the CSS planning area interrupt the natural course and pattern of the river. One water supply impoundment is O'Shaughnessy Reservoir located near River Mile 148 with approximately 980 square miles upstream. The other water supply impoundment is Griggs Reservoir located near River Mile 138 with approximately 1040 square miles upstream. Low head dams are as follows:

- Dublin Road Dam located near River Mile 132.0
- Main Street Dam located at River Mile 130.0
- Greenlawn Dam located near River Mile 129.0

Besides the two major water supply impoundments and the three low head dams, the river has been channelized in central and south Columbus for flood protection. This channeling has modified the natural geometry with some portions of the modified channel being reinforced with concrete retaining walls. In other flood-protected areas, earthen levees are used to create a floodway through central Columbus and south of State Route 104. In the area between these earthen levees, the

river widens and deepens into an extremely large pool, one that appears to be the river adapting to the large hydraulic inputs the river has received over the decades in between central Columbus and south of State Route 104. Appendix H of the City's Draft 2001 *General Engineering Report* (Draft GER01) contains details of this pool.

The river gradient generally increases in an upstream direction. Between its Big Darby Creek confluence and approximately River Mile 109, the gradient equals approximately 1.0 foot per mile. Except for a more steeply sloped area near River Mile 123, the gradient of the river ranges between 1.5 and 1.8 feet per mile between River Mile 109 and River Mile 129. Above River Mile 129 and River Mile 133, the weir elevation of the three low head dams mostly identifies the slope of the water column.

Flowing over a buried valley filled with glacial outwash materials of sand and coarse gravels, the Scioto River substrates vary from limestone bedrock and silt-muck above Columbus to coarse sand and gravel south of the city. Downstream of the Jackson Pike WWTP, the river is a free flowing river with good sinuosity amid riffle-pool development. The river valley, broad and poorly defined south of Columbus, has been subject to extensive flooding in the floodplain area.

■ **Qualitative Habitat Evaluation:**

In the WWMP planning area, the qualitative habitat of the Scioto River is one that indicates that the fish community in the river ought to exhibit some stress given the 2003 –2004 streambed conditions. As the river flows from the Dublin Road Dam boundary to its confluence with Big Darby Creek, the Qualitative Habitat Evaluation Index (QHEI) scores vary between a moderately strong warm water habitat and a significantly limited warm water habitat. The QHEI scores in the freely flowing portions of the river are indicative of a habitat that varies within the upper range of scores for Warm Water Habitat (WWH) in the Eastern Corn Belt Plains ecoregion (a range between 60 and 88 with the 25% quartile being 73 and the 75% quartile being 79). Within the significantly impounded portions of the river within 4.5 miles of its Olentangy River confluence, the QHEI scores of the river are below the range of scores for Modified Warm Water Habitat (MWH) in the Eastern Corn Belt Plains ecoregion (a range between 56 and 71 with the 25% quartile being 58).

■ **Individual Physical Characteristics of the Olentangy River**

■ **Setting:**

The 89 mile long Olentangy River originates in Crawford County at an approximate elevation of 1189 feet msl and has a total drainage area of approximately 540 square miles. From its origin, the river flows south across Marion, Delaware and Franklin counties to its Scioto River confluence at an approximate elevation of 702 feet msl.

The portion of the river within WWMP planning area is approximately 6 miles long. Into this length of the river drains approximately 46 square miles.

The portion of the river in the existing CSS is approximately the lower 4 river miles of the river. The length of the surface waters affected by the existing CSS begins near River Mile 3.79 below Dodridge Street in central Columbus at an approximate elevation of 710 feet msl and ends at its Scioto River confluence.

One major impoundment and many low head dams interrupt the natural course of the river between its headwaters and its Scioto River confluence. The major impoundment is the Delaware Lake located near River Mile 32 with an approximate spillway elevation of 884 feet msl. Approximately 393 square miles of the entire Olentangy River basin are located upstream of the Delaware Lake. Low head dams within the WWMP planning area are as follows:

- State Route 161 Dam located near River Mile 9.4
- Broadmeadows Dam located near River Mile 8.5
- North Broadway Dam located near River Mile 5.1
- Union Cemetery Dam located near River Mile 4.4
- Dodridge Dam located near River Mile 4.0
- Fifth Avenue Dam located near River Mile 1.9

The river gradient generally increases in an upstream direction. While the average fall per mile of the river is 5.6 feet per mile between its Scioto River confluence and the Delaware Dam, the gradient is equal to approximately 0.1 feet per mile in the impounded portions of the river and approximately 3.0 feet per mile in the free flowing portions between its Scioto River confluence and approximately River Mile 5.5. Between approximately River Mile 5.5 and the WWMP planning area boundary, the gradient increases from approximately 2.6 feet per mile to approximately 4.0 feet per mile.

■ **Qualitative Habitat Evaluation:**

In the WWMP planning area, the qualitative habitat of the Olentangy River is one that indicates that the fish community in the river ought to exhibit some stress given the 2003 – 2004 streambed conditions. As the river flows from the WWMP planning area boundary to its confluence with the Scioto River, the QHEI scores vary between a moderately strong warm water habitat and a significantly limited warm water habitat. The QHEI scores in the freely flowing portions of the river are indicative of a habitat below the mid-range scores for WWH in the Eastern Corn Belt Plains ecoregion (a range between 60 and 88 with the 25% quartile being 73). Within the significantly impounded portions of the river within 4.5 miles of its Scioto River confluence, the QHEI scores of the river are generally within the mid-range scores for MWH in the Eastern Corn Belt Plains ecoregion (a range between 56 and 71 with the 25% quartile being 58). At River Mile 2.0 near Fifth Avenue, the QHEI score is amongst the lowest of any locations in all the surface waters within the entire WWMP planning area.

- **Individual Physical Characteristics of the Big Walnut Creek**

- **Setting:**

The 56 mile long Big Walnut Creek has its headwaters in Morrow County at an approximate elevation of 1165 feet and drains approximately 557 square miles. From its origin, the creek flows across Morrow, Delaware and Franklin counties for approximately 38 river miles before heading southwest to its confluence with the Scioto River at an approximate elevation of 667 feet.

The portion of the creek within WWMP planning area is approximately 40 miles long and drains approximately 105 square miles exclusive of areas draining into the Alum Creek and Blacklick Creek. This area begins at Hoover Reservoir Dam northeast of Columbus at an approximate elevation of 820 feet msl and ends at its Scioto River confluence.

The portion of the creek in and downstream of the existing CSS is approximately the lower 15 river miles of the creek. The possible impact area begins at Three Creeks Park in southeast Columbus at an approximate elevation of 702 feet msl and ends at its Scioto River confluence.

One major water supply impoundment and one low head dam upstream of the existing CSS planning area interrupt the natural course of the river and its dendritic stream pattern. The major impoundment is Hoover Reservoir located near River Mile 38 with approximately 190 upstream square miles. The low head dam is the Morse Road Dam used for drinking water supply diversion, located near River Mile 32.

The creek gradient generally increases in an upstream direction. Between its Big Walnut Creek confluence and approximately River Mile 4.5, the gradient equals approximately 6 feet per mile. Except for a level area near River Mile 15, the gradient of the creek increases to approximately 17 feet per mile near its headwaters.

- **Qualitative Habitat Evaluation:**

In the WWMP planning area, the qualitative habitat of the Big Walnut Creek is one that indicates that the fish community in the creek ought not to exhibit stress due to the 2003 – 2004 streambed conditions. As the creek flows from the WWMP planning area boundary to its confluence with the Scioto River, all QHEI scores are indicative of the presence of a very strong warm water habitat. The QHEI scores are all well above the mid-range scores for the WWH in the Eastern Corn Belt Plains ecoregion (a range between 60 and 88 with the 75% quartile being 79).

- **Individual Physical Characteristics of the Alum Creek**

- **Setting:**

The 56 mile long Alum Creek originates in Morrow County at an approximate elevation of 1189 feet and has a total drainage area of approximately 199 square miles. From its origin, the river flows south across Morrow, Delaware and Franklin counties to its Big Walnut Creek confluence at an approximate elevation of 702 feet msl.

The portion of the creek within WWMP planning area is approximately 7 miles long and drains approximately 53 square miles. This area begins at the Westerville Water Intake Dam northeast of Columbus at an approximate elevation of 800 feet msl and ends at its Big Walnut Creek confluence at an approximate elevation of 702 feet msl.

The portion of the creek in and downstream of the existing CSS is approximately the lower 7 miles of the creek. The possible impact area begins at Main Street in central Columbus at an approximate elevation of 745 feet msl and ends at its Big Walnut Creek confluence.

The creek has one major dam and four low head dams between its headwaters and its Scioto River confluence. The major dam is the Alum Creek Dam upstream of the WWMP planning area located near River Mile 27 with a spillway elevation of 884 feet. Approximately 121 square miles of the entire Alum Creek basin are located upstream of the Alum Creek Dam. The four following low head dams are all located within the WWMP planning area:

- West Main Street in Westerville near River Mile 21.0
- Nelson Park near River Mile 9.0
- Franklin Park near River Mile 7.5
- State Route 104 near River Mile 4.0

The creek gradient generally increases in an upstream direction. Between its Big Walnut Creek confluence and approximately River Mile 3, the gradient is equal to approximately 3.0 feet per mile. Between the approximate River Mile 3 location and the WWMP upstream boundary, the gradient of the creek increases to and stabilizes at approximately 6.0 feet per mile except where interrupted by one of the three low head dams upstream of River Mile 3.

■ **Qualitative Habitat Evaluation:**

In the WWMP planning area, the qualitative habitat of the Alum Creek is one that indicates that the fish community in the creek ought to exhibit slight stress due to the 2003 – 2004 streambed conditions. As the creek flows from the WWMP planning area boundary to its confluence with the Big Walnut Creek, the QHEI scores vary between a moderately strong warm water habitat and a strong warm water habitat. The QHEI scores in the freely flowing portions of the creek are indicative of a habitat well above the mid-range scores for WWH in the Eastern Corn Belt Plains ecoregion (a range between 60 and 88 with the 75% quartile being 79). Within the impounded portions of the creek, the QHEI scores of the creek are near or slightly below the WWH mid-range scores for the Eastern Corn Belt Plains ecoregion (a range between 60 and 88 with the 25% quartile being 73).

- **Individual Physical Characteristics of the Blacklick Creek**

- **Setting:**

The 26 mile long Blacklick Creek originates in Franklin County at an approximate elevation of 1100 feet and has a total drainage area of approximately 63 square miles. From its origin, the creek flows south for approximately 15 river miles across Franklin County before heading southwest to its Big Walnut Creek confluence at an elevation of 702 feet msl.

While the entire drainage area of the creek is within WWMP planning area, only the lower portion the creek could be possibly impacted by the CSS. The creek is not within or downstream of the existing CSS area but is tributary to Big Walnut Creek at the river mile in Three Creeks Park as is Alum Creek.

The creek gradient generally increases in an upstream direction. Between its Big Walnut Creek confluence and approximately River Mile 4.5, the gradient is equals approximately 6.0 feet per mile. Except for a leveling off near River Mile 15, the gradient of the creek increases to approximately 17.0 feet per mile near its headwaters.

- **Qualitative Habitat Evaluation:**

In the WWMP planning area, the qualitative habitat of the Blacklick Creek is one that indicates that the fish community in the creek ought to exhibit slight stress due to the 2003 – 2004 streambed conditions. As the creek flows from the WWMP planning area boundary to its confluence with the Big Walnut Creek, the QHEI scores vary between a moderately strong warm water habitat and a strong warm water habitat. The QHEI scores in the freely flowing portions of the creek are indicative of a habitat well above the mid-range scores for WWH in the Eastern Corn Belt Plains ecoregion (a range between 60 and 88 with the 75% quartile being 79).

4.3.2.3 Upper Olentangy Surface Water Area – Summarization of 2003 – 2004 Baseline Data

As shown in **FIGURE 4.3.3**, the Upper Olentangy Surface Water Area has the following upstream and downstream boundaries:

- Upstream River Mile - 15.5 just south of the Franklin County/Delaware County boundary
- Downstream River Mile – 6.7 near Henderson Road

FIGURE 4.3.3 shows the following baseline data collection locations and activities in this surface water area from upstream location to downstream location:

Wilson Bridge Road Zone

- River Mile 13.2 –Mussels sampling site
- River Mile 11.5 – Biology – Fish sampling site
- River Mile 11.5 – Biology – Macroinvertebrates sampling site

- River Mile 11.04 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 11.04 – Bacteria – Fecal coliform and E. coli sampling site

State Route 161 Zone

- River Mile 9.73 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 9.73 – Bacteria – Fecal coliform and E. coli sampling site

Henderson Road Zone

- River Mile 6.77 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 6.77 – Bacteria – Fecal coliform and E. coli sampling site

For additional baseline data, one Olentangy River biological site was located above this surface waters area. This fish and macroinvertebrates sampling occurred at River Mile 15.0.

As shown in **FIGURE 4.3.3**, no existing Combined Sewer System (CSS) discharges are in this surface water area. Upstream of this zone, the river receives effluent from 2 major wastewater treatment plants in Delaware County.

The Upper Olentangy Surface Waters Area metering and sampling data contained in the receiving waters metering and sampling appendices is summarized in **TABLE 4.3.3**, **TABLE 4.3.4** and **TABLE 4.3.5**.

The chemical water quality standards values in **TABLE 4.3.3** through **TABLE 4.3.5** are the most restrictive current Ohio Water Quality Standards (WQS) derived from the 1) human health, agricultural water supply and aquatic life Outside Mixing Zone average values; 2) maximum aquatic life values; and 3) wildlife values. To determine the chemical water quality standards values for water column chemistry and ammonia-nitrogen, the following parameters and aquatic life use designations were applied to the appropriate chemistry tables in the current Ohio WQS:

- Metals:
 - Hardness – 200 mg/l as CaCO₃
- Ammonia Nitrogen:
 - Water Temperature – 29 °C
 - pH – 8.0
- Aquatic Life:
 - Exceptional Warm Water Habitat (EWH) for the Wilson Bridge Road Zone
 - Warm Water Habitat (WWH) for all other zones

4.3.2.4 Upper Olentangy Surface Water Area – 2003 – 2004 Surface Waters Area Characterization

The characterization of the baseline data summarized in **TABLE 4.3.3** through **TABLE 4.3.5** is based on the following:

- For temperature characterization - comparing monthly maximum values with the continuous metering database in the Receiving Waters Metering Baseline Data appendix
- For sediment characterization – comparing low probability of effect value and the likely probability of effect value in the Ohio EPA sediment quality reference guidelines with the sediment database in the exhibits
- For characterization of all other measures – comparing the numeric values in the current Ohio WQS with the summarized database in the exhibits

Based on the baseline data summarized in **TABLE 4.3.3** through **TABLE 4.3.5**, the 2003 - 2004 condition of the Olentangy River in this surface water area can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS, except:
 - At the Wilson Bridge Road Zone, the Ohio River Temperature Maxima were exceeded on May 13, 2004 between 4:45 p.m. and 10:00 p.m. and on May 14, 2004 between 6:15 p.m. and 7:00 p.m.
 - At the Henderson Road Zone, the daily Dissolved Oxygen (DO) minimum of 4.0 mg/l was exceeded on August 12, 2004 between 4:30 a.m. and 4:45 a.m.
 - All other maximum temperature standards were met
 - All other DO standards were met
 - All other water column chemistry standards were met
 - During wet weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS.
- Chemistry – Sediment
 - The river streambed sediment in this surface water area appears to contain a level of metals that would indicate a rare occurrence of adverse biological effects from the sediment chemistry
- Biology
 - The structure of the river in this surface water area appears to be capable of supporting EWH and WWH aquatic life as designated in the current Ohio WQS
 - The river in this surface water area appears to currently support EWH and WWH aquatic life where designated in the current Ohio WQS
- Bacteria

- During dry weather, the river in this surface water area experienced elevated bacteria concentrations which are of concern regarding Primary Contact recreational uses as follows:
 - At the Wilson Bridge Road Zone, E. coli concentrations of concern were sampled on August 8, 2004, August 17, 2004 and September 7, 2004
 - At the State Route 161 Zone, E. coli concentrations of concern were sampled on July 1, 2004, August 8, 2004, August 17, 2004 and September 7, 2004
 - At the Henderson Road Zone, E. coli concentrations of concern were sampled on August 17, 2004
 - None of the other dry weather E. coli samples contained concentrations of concern.
 - None of the dry weather samples for fecal coliform contained concentrations of concern.
- During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.

4.3.2.5 Lower Olentangy Surface Waters Area – Summarization of 2003 – 2004 Baseline Data

As shown in **FIGURE 4.3.4**, the Lower Olentangy Surface Waters Area has the following upstream and downstream boundaries:

- Upstream River Mile – 6.7 near Henderson Road
- Downstream River Mile - 0.5 near State Route 33

FIGURE 4.3.4 shows the following baseline data collection locations and activities in this surface water area:

Dodridge Street Zone

- River Mile 4.1 –Mussels sampling site
- River Mile 3.93 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 3.93 – Bacteria – Fecal coliform and E. coli sampling site
- River Mile 3.93 – Toxicity – Acute sampling site

John Herrick Drive Zone

- River Mile 2.55 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 2.55 – Bacteria – Fecal coliform and E. coli sampling site

Fifth Avenue Zone

- River Mile 2.1 – Biology – Fish sampling site
- River Mile 2.1 – Biology – Macroinvertebrates sampling site

- River Mile 1.5 –Mussels sampling site
- River Mile 1.85 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 1.85 – Bacteria – Fecal coliform and E. coli sampling site

Goodale Avenue Zone

- River Mile 0.81 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 0.81 – Bacteria – Fecal coliform and E. coli sampling site

As shown in **FIGURE 4.3.4**, the following list identifies the existing CSS discharges in this surface water area. The number of activations for each CSS point during the 2003 and 2004 receiving waters metering and sampling is also indicated.

- Hudson Avenue CSO at Olentangy River Mile 3.78 – *2 activations during the 2003 receiving waters metering and sampling and 8 activations during the 2004 receiving waters metering and sampling*
- Doe Alley CSO at Olentangy River Mile 3.08 – *0 activations during the 2003 receiving waters metering and sampling and 5 activations during the 2004 receiving waters metering and sampling*
- Frambes Avenue CSO at River Olentangy Mile 3.08 – *2 activations during the 2003 receiving waters metering and sampling and 6 activations during the 2004 receiving waters metering and sampling*
- Indianola Avenue CSO at Olentangy River Mile 2.47 – *1 activation during the 2003 receiving waters metering and sampling and 9 activations during the 2004 receiving waters metering and sampling*
- King Avenue CSO at Olentangy River Mile 1.89 – *0 activations during the 2003 receiving waters metering and sampling and 7 activations during the 2004 receiving waters metering and sampling*
- Third Avenue CSO at Olentangy River Mile 1.49 – *2 activations during the 2003 receiving waters metering and sampling and 9 activations during the 2004 receiving waters metering and sampling*
- First Avenue CSO at Olentangy River Mile 1.25 – *0 activations during the 2003 receiving waters metering and sampling and 7 activations during the 2004 receiving waters metering and sampling*

The Lower Olentangy Surface Waters Area does not receive any loads from any upstream CSS discharge. The Hudson Avenue CSO at River Mile 3.78 is the upstream-most CSO along the Olentangy River. Therefore, the Dodridge Street Zone baseline data can be considered to represent the 2003 - 2004 Olentangy River condition immediately upstream of the CSS.

The Lower Olentangy Surface Waters Area metering and sampling data contained in the receiving waters metering and sampling appendices is summarized in **TABLES 4.3.6 through 4.3.9**.

The chemical water quality standards values in **TABLE 4.3.6 through TABLE 4.3.9** are the most restrictive current Ohio WQS derived from the 1) human health, agricultural water supply and aquatic life Outside Mixing Zone average values; 2) maximum aquatic life values; and 3) wildlife values. The chemical water quality standards values in were determined from the appropriate chemistry tables in the current Ohio WQS. To determine the chemical water quality standards values for water column chemistry and ammonia-nitrogen, the following parameters and aquatic life use designations were applied to the appropriate chemistry tables in the current Ohio WQS:

- Metals:
 - Hardness – 200 mg/l as CaCO₃
- Ammonia Nitrogen:
 - Water Temperature – 29 °C
 - pH – 8.0
- Aquatic Life:
 - Warm Water Habitat – Dodridge Street Zone
 - Modified Warm Water Habitat – Impounded for all other zones

4.3.2.6 Lower Olentangy Surface Water Area – 2003 – 2004 Surface Waters Area Characterization

The characterization of the baseline data summarized in **TABLE 4.3.6 through TABLE 4.3.9** is based on the following:

- For temperature characterization - comparing monthly maximum values with the continuous metering database in the Receiving Waters Metering Baseline Data appendix
- For sediment characterization – comparing the low probability of effect value and the likely probability of effect value in the Ohio EPA sediment quality reference guidelines with the sediment database in the exhibits
- For characterization of all other measures – comparing the numeric values in the current Ohio WQS with the summarized database in the exhibits

Based on the baseline data summarized in **TABLE 4.3.6 through TABLE 4.3.9**, the 2003 - 2004 condition of the Olentangy River in this surface waters zone can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met

- During wet weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS, except:
 - All chemistry standards were met
- Chemistry – Sediment
 - The river streambed sediment in this surface water area at the Dodridge Street Zone and the John Herrick Drive Zone appears to contain a level of metals that would indicate a slight occurrence of adverse biological effects from sediments
 - The river streambed sediment in this surface water area at the Dodridge Street Zone and the Fifth Avenue Zone appears to contain a level of metals that would indicate some probable occurrence of adverse biological effects from sediments
 - At the Fifth Avenue Zone, the PEC (Probable Effects Concentration) for lead is exceeded
 - The river streambed sediment in this surface water area at the Goodale Avenue Zone appears to contain a level of metals that would indicate a rare occurrence of adverse biological effects from sediments
- Biology
 - The structure of the river in this surface water area appears to be capable of supporting WWH and MWH aquatic life in the locations as designated in the current Ohio WQS
 - The river in this surface water area appears to currently support WWH and MWH aquatic life where designated in the current Ohio WQS
- Bacteria
 - During dry weather, the river in this surface water area experienced elevated bacteria concentrations which are of concern regarding Primary Contact recreational uses as follows:
 - At the Dodridge Street Zone, the 30-day E. coli concentrations of concern were sampled on July 1, 2004, August 8, 2004 and August 17, 2004
 - At the John Herrick Drive Zone, the 30-day E. coli concentrations of concern were sampled on July 1, 2004, August 17, 2004 and September 7, 2004
 - At the Fifth Avenue Zone, the 30-day E. coli concentrations of concern were sampled on July 1, 2004 and August 17, 2004
 - At the Goodale Avenue Zone, the 30-day E. coli concentrations of concern were sampled on July 1, 2004
 - None of the other dry weather E. coli samples contained concentrations of concern.
 - None of the dry weather samples for fecal coliform contained concentrations of concern.
 - During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.

- Toxicity
 - The river in this surface water area appears to have no apparent acute toxicity during dry weather
 - The river in this surface water area appears to have no apparent acute toxicity during wet weather

4.3.2.7 Scioto-Downtown Surface Waters Area – Summarization of 2003 – 2004 Baseline Data

As shown in **FIGURE 4.3.5**, the Scioto-Downtown Surface Waters Area has the following upstream and downstream boundaries:

- Upstream Olentangy River Mile - 0.5 near State Route 33
- Upstream Scioto River Mile - 131.0 near the Dublin Road Dam
- Downstream River Mile - 128.0 near Greenlawn Avenue

FIGURE 4.3.5 shows the following baseline data collection locations and activities in this surface water area:

State Route 33 Zone (Olentangy River)

- River Mile 0.5 – Biology – Fish sampling site
- River Mile 0.5 – Biology – Macroinvertebrates sampling site
- River Mile 0.16 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 0.16 – Bacteria – Fecal coliform and E. coli sampling site

Souder Avenue Zone

- River Mile 133.0 –Mussels sampling site
- River Mile 131.83 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 131.83 – Bacteria – Fecal coliform and E. coli sampling site

Broad Street Zone

- River Mile 130.80 – Chemistry - Water Column metering and sampling and Sediment sampling site (1 continuous meter and 3 grab sampling sites)
- River Mile 130.80 – Bacteria – Fecal coliform and E. coli sampling site

Town Street Zone

- River Mile 130.55 – Chemistry - Water Column metering and sampling and Sediment sampling site (1 continuous meter and 3 grab sampling sites)
- River Mile 130.55 – Bacteria – Fecal coliform and E. coli sampling site

Main Street Zone

- River Mile 130.35 – Chemistry - Water Column metering and sampling and Sediment sampling site (3 continuous meters and 3 grab sample sites)
- River Mile 130.35 – Bacteria – Fecal coliform and E. coli sampling site
- River Mile 130.35 – Toxicity – Acute sampling site

Interstate 70 Zone

- River Mile 129.35 – Chemistry - Water Column metering
- River Mile 129.1 – Biology – Fish sampling site
- River Mile 129.1 – Biology – Macroinvertebrates sampling site

Greenlawn Avenue Zone

- River Mile 128.8 –Mussels sampling site
- River Mile 128.61 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 128.61 – Bacteria – Fecal coliform and E. coli sampling site
- River Mile 128.4 – Biology – Fish sampling site
- River Mile 128.2 – Biology – Macroinvertebrates sampling site

As shown in **FIGURE 4.3.5**, the following existing CSS discharges are in this surface water area. The number of activations for each CSS discharge during the 2003 - 2004 receiving waters metering and sampling is also indicated.

- Henry Street CSO at Scioto River Mile 131.19 – *3 activations during the 2003 receiving waters metering and sampling and 7 activations during the 2004 receiving waters metering and sampling*
- Kerr and Russell Streets CSO at Scioto River Mile 130.95 – *1 activation during the 2003 receiving waters metering and sampling and 14 activations during the 2004 receiving waters metering and sampling*
- Chestnut Street CSO at Scioto River Mile 130.95 – *4 activations during the 2003 receiving waters metering and sampling and 12 activations during the 2004 receiving waters metering and sampling*
- Spring Street CSO at Scioto River Mile 130.95 – *0 activations during the 2003 receiving waters metering and sampling and 0 activations during the 2004 receiving waters metering and sampling*
- Long Street CSO at Scioto River Mile 130.95 – *4 activations during the 2003 receiving waters metering and sampling and 10 activations during the 2004 receiving waters metering and sampling*
- Broad Street CSO at Scioto River Mile 130.72 – *1 activation during the 2003 receiving waters metering and sampling and 8 activations during the 2004 receiving waters metering and sampling*

- Capital Street CSO at Scioto River Mile 130.71 – 0 activations during the 2003 receiving waters metering and sampling and 0 activations during the 2004 receiving waters metering and sampling
- State Street CSO at Scioto River Mile 130.66 – 0 activations during the 2003 receiving waters metering and sampling and 0 activations during the 2004 receiving waters metering and sampling
- Rich Street CSO at Scioto River Mile 130.47 – 0 activations during the 2003 receiving waters metering and sampling and 0 activations during the 2004 receiving waters metering and sampling
- Cherry and Fourth Streets CSO at Scioto River Mile 130.40 – 1 activation during the 2003 receiving waters metering and sampling and 45 activations during the 2004 receiving waters metering and sampling
- Town and Fourth Streets CSO at Scioto River Mile 130.40 – 0 activations during the 2003 receiving waters metering and sampling and 42 activations during the 2004 receiving waters metering and sampling
- Mound Street and Grant Avenue CSO at Scioto River Mile 130.40 – 1 activation during the 2003 receiving waters metering and sampling and 83 activations during the 2004 receiving waters metering and sampling
- Noble Street and Grant Avenue CSO at Scioto River Mile 130.40 – 2 activations during the 2003 receiving waters metering and sampling and 80 activations during the 2004 receiving waters metering and sampling
- Noble Street and Fourth Street CSO at Scioto River Mile 130.40 – 0 activations during the 2003 receiving waters metering and sampling and 19 activations during the 2004 receiving waters metering and sampling
- Dodge Park Combined Pump Station CSO at Scioto River Mile 129.92 – 0 activations during the 2003 receiving waters metering and sampling and 0 activations during the 2004 receiving waters metering and sampling
- Mound Street east of Interstate 71 CSO at Scioto River Mile 128.69 – 0 activations during the 2003 receiving waters metering and sampling and 4 activations during the 2004 receiving waters metering and sampling
- Liberty Street (Peters Run) CSO at Scioto River Mile 128.69 – 2 activations during the 2003 receiving waters metering and sampling and 12 activations during the 2004 receiving waters metering and sampling
- Whittier Street CSO at Scioto River Mile 128.69 – 4 activations during the 2003 receiving waters metering and sampling and 16 activations during the 2004 receiving waters metering and sampling
- Whittier Street Storm Standby Tanks CSO at Scioto River Mile 128.78 – 5 activations during the 2003 receiving waters metering and sampling and 21 activation during the 2004 receiving waters metering and sampling
- Whittier Street Storm Standby Tanks Bypass CSO at Scioto River Mile 128.78 – 1 activation during the 2003 receiving waters metering and sampling and 4 activations during the 2004 receiving waters metering and sampling

The Scioto River in this surface water area receives all loads from any existing CSS discharges that occur within the upstream Lower Olentangy Surface Waters Area. The State Route 33 Zone (Olentangy River) baseline data can be considered to represent the 2003 - 2004 Olentangy River condition immediately downstream of all Olentangy River CSOs. The State Route 33 Zone (Olentangy River) is upstream of other CSO discharges into the Scioto River.

Additionally, the Scioto River does not receive any loads from any existing CSS discharge upstream along the Scioto River. The Henry Street CSO at River Mile 131.19 is the upstream-most CSO along the Scioto River. Therefore, the Souder Avenue Zone baseline data can be considered to represent the 2003 – 2004 Scioto River condition immediately upstream of the existing CSS discharges into the Scioto River.

The Scioto-Downtown Surface Waters Area metering and sampling data contained in the receiving waters metering and sampling appendices is summarized in **TABLES 4.3.10 through 4.3.16**.

The chemical water quality standards values in **TABLE 4.3.10** through **TABLE 4.3.16** are the most restrictive current Ohio WQS derived from the 1) human health, agricultural water supply and aquatic life Outside Mixing Zone average values; 2) maximum aquatic life values; and 3) wildlife values. The chemical water quality standards values were determined from the appropriate chemistry tables in the current Ohio WQS. To determine the chemical water quality standards values for water column chemistry and ammonia-nitrogen, the following parameters and aquatic life use designations were applied to the appropriate chemistry tables in the current Ohio WQS:

- Metals:
 - Hardness – 200 mg/l as CaCO₃
- Ammonia Nitrogen:
 - Water Temperature – 29 °C
 - pH – 8.0
- Aquatic Life:
 - Warm Water Habitat (WWH) – Souder Avenue Zone and the Greenlawn Avenue Zone
 - Modified Warm Water Habitat (MWH) – Impounded for all other zones

4.3.2.8 Scioto-Downtown Surface Water Area – 2003 – 2004 Surface Waters Area Characterization

The characterization of the baseline data summarized in **TABLES 4.3.10 through 4.3.16** is based on the following:

- For temperature characterization - comparing monthly maximum values with the continuous metering database in the Receiving Waters Metering Baseline Data appendix

- For sediment characterization – comparing the low probability of effect value and the likely probability of effect value in the Ohio EPA sediment quality reference guidelines with the sediment database in the exhibits
- For characterization of all other measures – comparing the numeric values in the current Ohio WQS with the summarized database in the exhibits

Based on the baseline data summarized in **TABLES 4.3.10** through **4.3.16**, the 2003 - 2004 condition of the Scioto River in this surface water area can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS, except:
 - At the Souder Avenue Zone, DO was less than 4 mg/l on September 14, 2004 between 5:15 a.m. and 10:46 a.m.
 - At the Broad Street zone, DO was less than 3 mg/l on August 18, 2004 between 1:30 a.m. and 2:46 a.m.
 - At the Town Street zone, DO was less than 3 mg/l on August 18, 2004 between 7:15 a.m. and 10:15 a.m., 12:30 p.m. and 3:01 p.m. and 4:16 p.m. and 4:46 p.m.
 - All other DO standards were met
 - All other chemistry standards were met
 - During wet weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS, except:
 - At the State Route 33 Zone (Olentangy River), DO was less than 3 mg/l on August 28, 2004 between 6:00 a.m. and 10:30 a.m.
 - At the Broad Street zone, DO was less than 3 mg/l on August 18, 2004 between 5:30 a.m. and 6:00 a.m. and on August 20, 2004 between 7:16 a.m. and 10:46 a.m.
 - At the Town Street zone, DO was less than 3 mg/l on August 20, 2004 between 8:46 a.m. and 5:30 p.m.
 - All other DO standards were met
 - All other chemistry standards were met
- Chemistry – Sediment
 - The streambed sediment in this surface water area at the State Route 33 (Olentangy River) Zone contain a level of metals that would indicate a rare occurrence of adverse biological effects from sediment
 - The streambed sediment in this surface water area at 2 of the 3 Main Street Zones contain a level of metals that would indicate a probable occurrence of adverse biological effects from sediment
 - At 2 of the 3 Main Street Zone sampling sites, the PEC for lead is exceeded
 - The streambed sediment in this surface water area at the other zones contain a level of metals that would indicate a slight occurrence of adverse biological effects from sediment

- **Biology**
 - The structure of the rivers in this surface waters appear to be capable of supporting WWH and MWH aquatic life in the locations as currently designated in Ohio WQS
 - The rivers in this surface water area appear to currently support WWH and MWH aquatic life where designated in the current Ohio WQS
- **Bacteria**
 - During dry weather, the river in this surface water area experienced elevated bacteria concentrations which are of concern regarding Primary Contact recreational use as follows:
 - At the State Route 33 Zone (Olentangy River), E. coli concentrations of concern were sampled during all dry weather sampling
 - None of the other dry weather E. coli samples contained concentrations of concern.
 - None of the dry weather samples for fecal coliform contained concentrations of concern
 - During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.
- **Toxicity**
 - The rivers in this surface water area appear to have no apparent acute toxicity during dry weather
 - The rivers in this surface water area appear to have no acute apparent toxicity during wet weather

4.3.2.9 Scioto-South Columbus Surface Waters Area – Summarization of 2003 – 2004 Baseline Data

As shown in **FIGURE 4.3.6**, the Scioto-South Columbus Surface Waters Area has the following upstream and downstream boundaries:

- Upstream River Mile – 128.0 near Greenlawn Avenue
- Downstream River Mile - 123.0 near Interstate 270

FIGURE 4.3.6 shows the following baseline data collection locations and activities in this surface water area:

State Route 104 Zone

- River Mile 126.97 – Chemistry - Water Column metering and sampling and Sediment sampling site (2 samples)
- River Mile 126.97 – Bacteria – Fecal coliform and E. coli sampling site
- River Mile 126.97 – Toxicity – Acute sampling site

Jackson Pike Zone

- River Mile 126.43 – Chemistry - Water Column metering
- River Mile 126.43 – Toxicity – Acute sampling site

Interstate 270 Zone

- River Mile 123.58 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 123.58 – Bacteria – Fecal coliform and E. coli sampling site
- River Mile 123.5 – Mussels sampling site

As shown in **FIGURE 4.3.6**, the following existing CSS discharges are in this surface water area. The number of activations for each existing CSS discharge during the 2003 and 2004 receiving waters metering and sampling is also indicated.

- Moler Street CSO at Scioto River Mile 128.34 – *2 activations during the 2003 receiving waters metering and sampling and 15 activations during the 2004 receiving waters metering and sampling*
- Markison Avenue CSO at Scioto River Mile 127.55 – *3 activations during the 2003 receiving waters metering and sampling and 15 activations during the 2004 receiving waters metering and sampling*

Also as shown in **FIGURE 4.3.6**, the three outfalls from the Jackson Pike WWTP site are in this surface water area. Outfall 001 (Jackson Pike WWTP Outfall) is located at River Mile 126.20. The drainage swale that receives discharges from Outfall 002 (Jackson Pike Gravity Bypass) is tributary to the river at River Mile 126.51. Outfall 003 (Jackson Pike Hydraulic Bypass) is located at River Mile 126.43.

Additionally, the Scioto River in this surface water area receives all loads from any existing CSS discharges that occur within the upstream Scioto-Downtown and Lower Olentangy surface waters areas. The only existing CSS discharge not tributary to the Scioto-South Columbus Surface Waters Area is the Alum Creek CSO that enters the Scioto River in the Scioto-Big Walnut Confluence Surface Waters Area characterized later in this section.

The Scioto-South Columbus Surface Waters Area metering and sampling data contained in the receiving waters metering and sampling appendices is summarized in **TABLES 4.3.17** through **4.3.19**.

The chemical water quality standards values in **TABLE 4.3.17** through **TABLE 4.3.19** are the most restrictive current Ohio WQS derived from the 1) human health, agricultural water supply and aquatic life Outside Mixing Zone average values; 2) maximum aquatic life values; and 3) wildlife values. The chemical water quality standards values were determined from the appropriate chemistry tables in the current Ohio WQS. To determine the chemical water quality standards values for water column chemistry and ammonia-nitrogen, the following parameters and aquatic life use designations were applied to the appropriate chemistry tables in the current Ohio WQS:

- Metals:
 - Hardness – 200 mg/l as CaCO₃
- Ammonia Nitrogen:
 - Water Temperature – 29 °C
 - pH – 8.0
- Aquatic Life:
 - Warm Water Habitat for all zones

4.3.2.10 Scioto-South Columbus Surface Water Area – 2003 – 2004 Surface Waters Area Characterization

The characterization of the baseline data summarized in **TABLE 4.3.17** through **TABLE 4.3.19** is based on the following:

- For temperature characterization - comparing monthly maximum values with the continuous metering database in the Receiving Waters Metering Baseline Data appendix
- For sediment characterization – comparing the low probability of effect value and the likely probability of effect value in the Ohio EPA sediment quality reference guidelines with the sediment database in the exhibits
- For characterization of all other measures – comparing the numeric values in the current Ohio WQS with the summarized database in the exhibits

Based on the baseline data summarized in **TABLE 4.3.17** through **TABLE 4.3.19**, the 2003 - 2004 condition of the Scioto River in this surface water area can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS, except:
 - At the Jackson Pike Zone, DO was less than 4 mg/l on July 14, 2004 between 1:00 a.m. and 12:00 p.m.
 - All other DO standards were met
 - All other chemistry standards were met
 - During wet weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS, except:
 - At the State Route 104 Zone, DO dropped below 4.0 mg/l on August 13, 2004 at 8:01 a.m. and at 12:31 p.m. and on August 14, 2004 between 12:45 a.m. and 11:01 a.m.
 - At the Jackson Pike Zone, DO was less than 4 mg/l between July 11, 2004 at 9:46 a.m. and July 12, 2004 at 2:16 p.m., on July 13, 2004 between 12:15 a.m. and 12:00 p.m., on August 14, 2004 between 5:31 a.m. and 8:01 a.m. and on September 8, 2004 between 10:00 a.m. and 1:15 p.m.
 - All other DO standards were met

- All other chemistry standards were met
- Chemistry – Sediment
 - The streambed sediment in this surface water area appears to contain a level of metals that would indicate a slight occurrence of adverse biological effects from sediment
- Biology
 - The structure of the river in this surface water area appears to be capable of supporting WWH aquatic life as designated in the current Ohio WQS
 - The river in this surface water area appears to currently only partially support WWH aquatic life
- Bacteria
 - During dry weather, the river in this surface water area experienced elevated bacteria concentrations which are of concern regarding Primary Contact recreational uses as follows:
 - At the State Route 104 Zone, E. coli concentrations of concern were sampled on August 8, 2004 and August 17, 2004
 - At the I-270 Zone, E. coli concentrations of concern were sampled on all dry weather sampling
 - At the I-270 Zone, fecal coliform concentrations of concern were sampled on August 8, 2004 and August 17, 2004
 - None of the other dry weather E. coli samples contained concentrations of concern.
 - None of the other dry weather samples for Fecal coliform contained concentrations of concern.
 - During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.
- Toxicity
 - The river in this surface water area appears to have no apparent acute toxicity during dry weather
 - The river in this surface water area appears to have no apparent acute toxicity during wet weather

4.3.2.11 Upper Alum Creek Surface Waters Area – Summarization of 2003 –2004 Baseline Data

As shown in **FIGURE 4.3.7**, the Upper Alum Creek Surface Waters Area has the following upstream and downstream boundaries:

- Upstream River Mile - 25.2 near Franklin County/Delaware County boundary
- Downstream River Mile - 11.0 near Mock Road

FIGURE 4.3.7 shows the following baseline data collection locations and activities in this surface water area:

Cleveland Avenue Zone

- River Mile 25.2 – Biology – Fish sampling site
- River Mile 25.2 – Biology – Macroinvertebrates sampling site
- River Mile 25.2 – Mussels sampling site
- River Mile 21.01 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 21.01 – Bacteria – Fecal coliform and E. coli sampling site
- River Mile 21.0 – Mussels sampling site

State Route 3 Zone

- River Mile 18.06 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 18.06 – Bacteria – Fecal coliform and E. coli sampling site

Mock Road Zone

- River Mile 11.1 – Biology – Fish sampling site
- River Mile 11.1 – Biology – Macroinvertebrates sampling site
- River Mile 11.23 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 11.23 – Bacteria – Fecal coliform and E. coli sampling site

As shown in **FIGURE 4.3.7**, no existing CSS discharges are in this surface water area. Within this zone, the creek receives effluent from 1 major wastewater treatment plant.

The Upper Alum Creek Surface Waters Area metering and sampling data contained in the receiving waters metering and sampling appendices is summarized in **TABLES 4.3.20** through **4.3.22**.

The chemical water quality standards values in **TABLE 4.3.20** through **TABLE 4.3.22** are the most restrictive current Ohio WQS derived from the 1) human health, agricultural water supply and aquatic life Outside Mixing Zone average values; 2) maximum aquatic life values; and 3) wildlife values. The chemical water quality standards values were determined from the appropriate chemistry tables in the current Ohio WQS. To determine the chemical water quality standards values for water column chemistry and ammonia-nitrogen, the following parameters and aquatic life use designations were applied to the appropriate chemistry tables in the current Ohio WQS:

- Metals:
 - Hardness – 200 mg/l as CaCO₃
- Ammonia Nitrogen:

- Water Temperature – 29 °C
- pH – 8.0
- Aquatic Life:
 - Warm Water Habitat for all zones

4.3.2.12 Upper Alum Creek Surface Water Area – 2003 – 2004 Surface Waters Area Characterization

The characterization of the baseline data summarized in **TABLE 4.3.20** through **TABLE 4.3.22** are based on the following:

- For temperature characterization - comparing monthly maximum values with the continuous metering database in the Receiving Waters Metering Baseline Data appendix
- For sediment characterization – comparing the low probability of effect value and the likely probability of effect value in the Ohio EPA sediment quality reference guidelines with the sediment database in the exhibits
- For characterization of all other measures – comparing the numeric values in the current Ohio WQS with the summarized database in the exhibits

Based on the baseline data summarized in **TABLE 4.3.20** through **TABLE 4.3.22**, the 2003 - 2004 condition of Alum Creek in this surface water area can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS, except:
 - At the Cleveland Avenue, State Route 3 and Mock Road zones, copper was exceeded on July 12, 2004, September 8, 2004 and September 9, 2004
 - All other chemistry standards were met
 - During wet weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS.
 - All chemistry standards were met
- Chemistry – Sediment
 - The streambed sediment in this surface water area at the Mock Road Zone appears to contain a level of metals that would indicate a rare occurrence of adverse biological effects from sediment
 - The streambed sediment in this surface water area at the other zones appears to contain a level of metals that would indicate a slight occurrence of adverse biological effects from sediment
- Biology
 - The structure of the creek in this surface waters zone appears to be capable of supporting WWH aquatic life as designated in the current Ohio WQS
 - The creek in this surface water area appears to currently support WWH aquatic life

- Bacteria
 - During dry weather, the river in this surface water area experienced elevated bacteria concentrations which are of concern regarding Primary Contact recreational uses as follows:
 - At the Cleveland Avenue Zone, E. coli concentrations of concern were sampled on July 1, 2004, August 8, 2004, August 17, 2004 and September 7, 2004
 - At the Cleveland Avenue Zone, fecal coliform concentrations of concern were sampled on August 17, 2004
 - At the State Route 3 Zone, E. coli concentrations of concern were sampled on August 8, 2004 and on August 17, 2004
 - None of the other dry weather E. coli samples contained concentrations of concern.
 - None of the other dry weather samples for Fecal coliform contained concentrations of concern.
 - During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.

4.3.2.13 Lower Alum Creek Surface Waters Area – Summarization of 2003 –2004 Baseline Data

As shown in **FIGURE 4.3.8**, the Upper Alum Creek Surface Waters Area has the following upstream and downstream boundaries:

- Upstream River Mile - 11.0 near Mock Road
- Downstream River Mile - 4.0 near State Route 104

FIGURE 4.3.8 shows the following baseline data collection locations and activities in this surface water area:

Main Street Zone

- River Mile 7.00 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 7.00 – Bacteria – Fecal coliform and E. coli sampling site
- River Mile 7.00 – Toxicity – Acute sampling site
- River Mile 6.7 – Biology – Fish sampling site
- River Mile 6.7 – Biology – Macroinvertebrates sampling site

Livingston Avenue Zone

- River Mile 6.36 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 6.36 – Bacteria – Fecal coliform and E. coli sampling site

- River Mile 6.36 – Toxicity – Acute sampling site
- River Mile 4.1 –Mussels sampling site

As shown in **FIGURE 4.3.8**, the following existing CSS discharge is in this surface water area. The number of activations for the existing CSS discharge during the 2003 - 2004 receiving waters metering and sampling is also indicated.

- Alum Creek Storm Standby Tank CSO at River Mile 6.92 – *6 activations during the 2003 receiving waters metering and sampling and 6 activations during the 2004 receiving waters metering and sampling*

Alum Creek in this surface water area does not receive any loads from upstream CSS discharges.

The Lower Alum Creek Surface Waters Area metering and sampling data contained in the receiving waters metering and sampling appendices is summarized in **TABLE 4.3.23** and **TABLE 4.3.24**.

The chemical water quality standards values in **TABLE 4.3.23** and **TABLE 4.3.24** are the most restrictive current Ohio WQS derived from the 1) human health, agricultural water supply and aquatic life Outside Mixing Zone average values; 2) maximum aquatic life values; and 3) wildlife values. The chemical water quality standards values in were determined from the appropriate chemistry tables in the current Ohio WQS. To determine the chemical water quality standards values for water column chemistry and ammonia-nitrogen, the following parameters and aquatic life use designations were applied to the appropriate chemistry tables in the current Ohio WQS:

- Metals:
 - Hardness – 200 mg/l as CaCO₃
- Ammonia Nitrogen:
 - Water Temperature – 29 °C
 - pH – 8.0
- Aquatic Life:
 - Warm Water Habitat for all zones

4.3.2.14 Lower Alum Creek Surface Water Area – 2003 – 2004 Surface Waters Area Characterization

The characterization of the baseline data summarized in **TABLE 4.3.23** and **TABLE 4.3.24** is based on the following:

- For temperature characterization - comparing monthly maximum values with the continuous metering database in the Receiving Waters Metering Baseline Data appendix
- For sediment characterization – comparing the low probability of effect value and the likely probability of effect value in the Ohio EPA sediment quality reference guidelines with the sediment database in the exhibits

- For characterization of all other measures – comparing the numeric values in the current Ohio WQS with the summarized database in the exhibits

Based on the baseline data summarized in **TABLE 4.3.23** and **TABLE 4.3.24**, the 2003 - 2004 conditions of Alum Creek in this surface water area can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met
- Chemistry – Sediment
 - The streambed sediment in this surface water area appears to contain a level of metals that would indicate a slight occurrence of adverse biological effects from sediment
- Biology
 - The structure of the creek in this surface waters zone appears to be capable of supporting WWH aquatic life as currently designated in Ohio WQS
 - The creek in this surface water area appears to currently only partially support WWH aquatic life as designated in the current Ohio WQS
- Bacteria
 - During dry weather, the river in this surface water area experienced elevated bacteria concentrations which are of concern regarding Primary Contact recreational uses as follows:
 - At the Main Street Zone, E. coli concentrations of concern were sampled on July 1, 2004, August 8, 2004 and August 17, 2004
 - At the Main Street Zone, E. coli concentrations of concern were sampled on August 8, 2004
 - At the Livingston Avenue Zone, E. coli concentrations of concern were sampled on July 1, 2004, August 8, 2004 and August 17, 2004
 - At the Livingston Avenue Zone, E. coli concentrations of concern were sampled on August 8, 2004
 - None of the other dry weather E. coli samples contained concentrations of concern.
 - None of the dry weather samples for Fecal coliform contained concentrations of concern.
 - During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.

- Toxicity
 - The creek in this surface water area appears to be have no apparent toxicity during dry weather
 - The creek in this surface water area appears to be have no apparent toxicity during wet weather

4.3.2.15 Three Rivers Surface Waters Area – Summarization of 2003 – 2004 Baseline Data

As shown in **FIGURE 4.3.9**, the Three Rivers Surface Waters Area has the following upstream and downstream boundaries:

- Upstream Alum Creek River Mile - 4.0 near State Route 104
- Upstream Blacklick Creek River Mile - 3.0 near Winchester Pike
- Upstream Big Walnut Creek River Mile - 16.0 near Williams Road
- Downstream Big Walnut Creek River Mile - 13.0 near Reese Road

FIGURE 4.3.9 shows the following baseline data collection locations and activities in this surface water area:

State Route 104 Zone (Alum Creek)

- River Mile 3.87 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 3.87 – Bacteria – Fecal coliform and E. coli sampling site

Williams Road Zone (Alum Creek)

- River Mile 0.7 – Biology – Fish sampling site
- River Mile 0.7 – Biology – Macroinvertebrates sampling site
- River Mile 0.70 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 0.70 – Bacteria – Fecal coliform and E. coli sampling site

Winchester Pike Zone (Blacklick Creek)

- River Mile 4.48 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 4.48 – Bacteria – Fecal coliform and E. coli sampling site
- River Mile 0.5 – Biology – Fish sampling site
- River Mile 0.5 – Biology – Macroinvertebrates sampling site

Williams Road Zone (Big Walnut Creek)

- River Mile 15.9 – Biology – Fish sampling site
- River Mile 15.9 – Biology – Macroinvertebrates sampling site

- River Mile 15.76 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 15.76 – Bacteria – Fecal coliform and E. coli sampling site

Reese Road Zone (Big Walnut Creek)

- River Mile 13.2 – Biology – Fish sampling site
- River Mile 13.2 – Biology – Macroinvertebrates sampling site
- River Mile 10.81 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 10.81 – Bacteria – Fecal coliform and E. coli sampling site

As shown in **FIGURE 4.3.9**, no existing CSS discharges are in this surface water area.

Alum Creek and Big Walnut Creek in this surface water area receives all loads from any existing CSS discharge that occurs within the upstream Lower Alum Creek Surface Waters Area.

The Three Rivers Surface Waters Area metering and sampling data contained in the receiving waters metering and sampling appendices is summarized in **TABLES 4.3.25** through **4.3.29**.

The chemical water quality standards values in **TABLE 4.3.25** through **TABLE 4.3.29** are the most restrictive current Ohio WQS derived from the 1) human health, agricultural water supply and aquatic life Outside Mixing Zone average values; 2) maximum aquatic life values; and 3) wildlife values. The chemical water quality standards values were determined from the appropriate chemistry tables in the current Ohio WQS. To determine the chemical water quality standards values for water column chemistry and ammonia-nitrogen, the following parameters and aquatic life use designations were applied to the appropriate chemistry tables in the current Ohio WQS:

- Metals:
 - Hardness – 200 mg/l as CaCO₃
- Ammonia Nitrogen:
 - Water Temperature – 29 °C
 - pH – 8.0
- Aquatic Life:
 - Exceptional Warm Water Habitat for the Williams Road Zone (Big Walnut Creek) and the Reese Road Zone (Big Walnut Creek)
- Warm Water Habitat for all other zones

4.3.2.16 Three Rivers Surface Water Area – 2003 – 2004 Surface Waters Area Characterization

The characterization of the baseline data summarized in **TABLE 4.3.25** through **TABLE 4.3.29** is based on the following:

- For temperature characterization - comparing monthly maximum values with the continuous metering database in the Receiving Waters Metering Baseline Data appendix
- For sediment characterization – comparing the low probability of effect value and the likely probability of effect value in the Ohio EPA sediment quality reference guidelines with the sediment database in the exhibits
- For characterization of all other measures – comparing the numeric values in the current Ohio WQS with the summarized database in the exhibits

Based on the baseline data summarized in **TABLE 4.3.25** and **TABLE 4.3.26**, the 2003 - 2004 condition of Alum Creek in this surface water area can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met
 - During wet weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met
- Chemistry – Sediment
 - The streambed sediment in this surface water area at both Alum Creek zones appear to contain a level of metals that would indicate some probability of occurrence of adverse biological effects from sediment
- Biology
 - The structure of the creek in this surface waters zone appears to be capable of partially supporting WWH aquatic life as designated in the current Ohio WQS
 - The QHEI evaluation of Lower Alum Creek evaluates the streambed currently as a recovering channel
 - The creek in this surface water area appears to currently only partially support WWH aquatic life
- Bacteria
 - During dry weather, the river in this surface water area did not experience elevated bacteria concentrations of concern regarding Primary Contact recreational uses as follows:
 - None of the dry weather E. coli samples contained concentrations of concern.
 - None of the dry weather samples for Fecal coliform contained concentrations of concern.
 - During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.

Based on the baseline data summarized in **TABLE 4.3.27**, the 2003 - 2004 condition of Blacklick Creek in this surface water area can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met
 - During wet weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS, except:
 - At the Winchester Pike Zone (Blacklick Creek), DO dropped below 4 mg/l on September 8, 2004 between 6:01 a.m. and 9:31 a.m.
 - All other DO standards were met
 - All other chemistry standards were met
- Chemistry – Sediment
 - The streambed sediment in this surface water area appears to contain a level of metals that would indicate a rare occurrence of adverse biological effects from the sediment
- Biology
 - The structure of the creek in this surface water area appears to be capable of supporting WWH aquatic life as designated in the current Ohio WQS
 - The creek in this surface water area appears to currently partially support WWH aquatic life
 - The fish community score for the Miwb was slightly less than the score for fully WWH aquatic life attainment
 - All other biological standards were met
- Bacteria
 - During dry weather, the river in this surface water area experienced elevated bacteria concentrations which are of concern regarding Primary Contact recreational uses as follows:
 - At the Winchester Pike Zone (Blacklick Creek), E. coli concentrations of concern were sampled on July 1, 2004, August 8, 2004 and August 17, 2004
 - None of the other dry weather E. coli samples contained concentrations of concern.
 - None of the dry weather samples for Fecal coliform contained concentrations of concern.
 - During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.

Based on the baseline data summarized in **TABLE 4.3.28** and **TABLE 4.3.29**, the 2003 - 2004 condition of Big Walnut Creek in this surface water area can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met
 - During wet weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS, except:
 - At the Reese Road Zone (Big Walnut Creek), DO was less than 5 mg/l on July 12, 2004 between 4:00 a.m. and 9:16 a.m.
 - All other chemistry standards were met
- Chemistry – Sediment
 - The streambed sediment in these surface waters area at both Big Walnut Creek zones appears to contain a level of metals that would indicate a slight occurrence of adverse biological effects from sediment
- Biology
 - The structure of the creek in this surface water area appears to be capable of supporting EWH aquatic life as designated in the current Ohio WQS
 - The creek in this surface water area appears to currently support EWH aquatic life
- Bacteria
 - During dry weather, the river in this surface water area experienced elevated bacteria concentrations which are of concern regarding Primary Contact recreational uses as follows:
 - At the Williams Road Zone (Big Walnut Creek), E. coli concentrations of concern were sampled on October 23, 2003 and September 7, 2004
 - At the Reese Road Zone (Big Walnut Creek), E. coli concentrations of concern were sampled on August 17, 2004
 - None of the other dry weather E. coli samples contained concentrations of concern.
 - None of the dry weather samples for fecal coliform contained concentrations of concern.
 - During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.

4.3.2.17 Scioto-Big Walnut Confluence Surface Waters Area – Summarization of 2003 – 2004 Baseline Data

As shown in **FIGURE 4.3.10**, the Scioto-Big Walnut Confluence Surface Waters Area has the following upstream and downstream boundaries:

- Upstream Big Walnut Creek River Mile – 3.6 near Rowe Road
- Upstream Scioto River Mile - 119.3 near State Route 665

- Downstream River Mile - 106.0 between State Route 762 and State Route 316

FIGURE 4.3.10 shows the following baseline data collection locations and activities in this surface water area:

Rowe Road Zone (Big Walnut Creek)

- River Mile 3.57 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 3.57 – Bacteria – Fecal coliform and E. coli sampling site
- River Mile 1.6 – Biology – Fish sampling site
- River Mile 1.6 – Biology – Macroinvertebrates sampling site

State Route 665 Zone (Scioto River)

- River Mile 119.9 – Biology – Fish sampling site
- River Mile 119.9 – Biology – Macroinvertebrates sampling site
- River Mile 119.08 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 119.08 – Bacteria – Fecal coliform and E. coli sampling site

State Route 762 Zone (Scioto River)

- River Mile 114.5 –Mussels sampling site
- River Mile 114.38 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 114.38 – Bacteria – Fecal coliform and E. coli sampling site

As shown in **FIGURE 4.3.10**, no existing CSS discharges are in this surface water area.

Also as shown in **FIGURE 4.3.10**, the two outfalls from the Southerly WWTP site are in this surface water area. Outfall 001 (Southerly WWTP Outfall) is located at River Mile 117.51. Outfall 002 (Southerly Bypass) is located at River Mile 117.89.

The Scioto River in this surface water area receives all loads from the following:

- Jackson Pike Wastewater Treatment Plant discharges in the Scioto-South Columbus Surface Waters Area
- Any CSS discharges that occur within the upstream Lower Olentangy, Scioto-Downtown and Scioto-South Columbus surface waters areas

Additionally, below the Big Walnut Creek confluence, the Scioto River in this surface water area receives all loads from any existing CSS discharges that occur within the upstream Lower Alum Creek Surface Waters Area.

Big Walnut Creek in this surface water area receives all loads from any existing CSS discharges that occur within the upstream Lower Alum Creek Surface Waters Area.

The Scioto-Big Walnut Confluence Surface Waters Area metering and sampling data contained in the receiving waters metering and sampling appendices is summarized in **TABLES 4.3.30 through 4.3.32**.

The chemical water quality standards values in **TABLE 4.3.30 through TABLE 4.3.32** are the most restrictive current Ohio WQS derived from the 1) human health, agricultural water supply and aquatic life Outside Mixing Zone average values; 2) maximum aquatic life values; and 3) wildlife values. The chemical water quality standards values in were determined from the appropriate chemistry tables in the current Ohio WQS. To determine the chemical water quality standards values for water column chemistry and ammonia-nitrogen, the following parameters and aquatic life use designations were applied to the appropriate chemistry tables in the current Ohio WQS:

- Metals:
 - Hardness – 200 mg/l as CaCO₃
- Ammonia Nitrogen:
 - Water Temperature – 29 °C
 - pH – 8.0
- Aquatic Life:
 - Exceptional Warm Water Habitat for the Rowe Road Zone
 - Warm Water Habitat for all other zones

4.3.2.18 Scioto-Big Walnut Confluence Surface Water Area – 2003 – 2004 Surface Waters Area Characterization

The characterization of the baseline data summarized in **TABLE 4.3.30 through TABLE 4.3.32** is based on the following:

- For temperature characterization - comparing monthly maximum values with the continuous metering database in the Receiving Waters Metering Baseline Data appendix
- For sediment characterization – comparing the low probability of effect value and the likely probability of effect value in the Ohio EPA sediment quality reference guidelines with the sediment database in the exhibits
- For characterization of all other measures – comparing the numeric values in the current Ohio WQS with the summarized database in the exhibits

Based on the baseline data as summarized in **TABLE 4.3.30**, the 2003 - 2004 condition of Big Walnut Creek in this surface water area can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met
 - During wet weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS

- All chemistry standards were met
- Chemistry – Sediment
 - The streambed sediment in this surface water area appears to contain a level of metals that would indicate a rare occurrence of adverse biological effects from sediment
- Biology
 - The habitat and structure of the creek in this surface water area appears to be capable of supporting EWH or WWH aquatic life as currently designated in Ohio WQS
 - The creek in this surface water area appears to currently support EWH aquatic life
- Bacteria
 - During dry weather, the river in this surface water area did not experience elevated bacteria concentrations which would be of concern regarding Primary Contact recreational uses as follows:
 - None of the dry weather E. coli and fecal coliform samples contained concentrations of concern.
 - During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.

Based on the baseline data summarized in **TABLE 4.3.31** and **TABLE 4.3.32**, the 2003 - 2004 condition of the Scioto River in this surface water area can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met
 - During wet weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met
- Chemistry – Sediment
 - The streambed sediment in this surface water area appear to contain a level of metals that would indicate a rare probability occurrence of adverse biological effects from sediment
- Biology
 - The structure of the river in this surface water area appears to be capable of supporting WWH aquatic life as designated in the current Ohio WQS
 - The river in this surface water area appears to currently support WWH aquatic life
- Bacteria

- During dry weather, the river in this surface water area experienced elevated bacteria concentrations which are of concern regarding Primary Contact recreational uses as follows:
 - At the State Route 665 Zone, E. coli concentrations of concern were sampled during all dry weather sampling.
 - At the State Route 665 Zone, fecal coliform concentrations of concern were sampled during all dry weather sampling.
 - At the State Route 762 Zone, E. coli concentrations of concern were sampled during all dry weather sampling
 - At the State Route 762 Zone, E. coli concentrations of concern were sampled on August 18, 2004 and September 7, 2004
 - None of the dry weather samples for fecal coliform contained concentrations of concern.
- During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.

4.3.2.19 Scioto-Little Walnut Confluence Surface Waters Area – Summarization of 2003 – 2004 Baseline Data

As shown in **FIGURE 4.3.11: Scioto-Little Walnut Confluence Surface Waters Area**, the Scioto-Walnut Confluence Surface Waters Area has the following upstream and downstream boundaries:

- Upstream River Mile - 106.0 between State Route 762 and State Route 316
- Downstream River Mile - 101.5 near Commercial Point Road

FIGURE 4.3.11 shows the following baseline data collection locations and activities in this surface water area:

State Route 316 Zone

- River Mile 109.2 – Biology – Fish sampling site
- River Mile 109.2 – Biology – Macroinvertebrates sampling site
- River Mile 108.46 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 108.46 – Bacteria – Fecal coliform and E. coli sampling site

Commercial Point Road Zone

- River Mile 102.0 – Biology – Fish sampling site
- River Mile 102.0 – Biology – Macroinvertebrates sampling site
- River Mile 101.13 – Chemistry - Water Column metering and sampling and Sediment sampling site
- River Mile 101.13 – Bacteria – Fecal coliform and E. coli sampling site

As shown in **FIGURE 4.3.11**, no CSS discharges are in this surface water area.

The Scioto River in this surface water area receives all loads from any existing CSS discharges that occur within the upstream Lower Olentangy, Scioto-Downtown, Scioto-South Columbus and Lower Alum Creek surface waters areas.

The Scioto-Little Walnut Surface Waters Area metering and sampling data contained in the receiving waters metering and sampling appendices is summarized in **TABLE 4.3.33** and **TABLE 4.3.34**.

The chemical water quality standards values in **TABLE 4.3.33** and **TABLE 4.3.34** are the most restrictive current Ohio WQS derived from the 1) human health, agricultural water supply and aquatic life Outside Mixing Zone average values; 2) maximum aquatic life values; and 3) wildlife values. The chemical water quality standards values in were determined from the appropriate chemistry tables in the current Ohio WQS. To determine the chemical water quality standards values for water column chemistry and ammonia-nitrogen, the following parameters and aquatic life use designations were applied to the appropriate chemistry tables in the current Ohio WQS:

- Metals:
 - Hardness – 200 mg/l as CaCO₃
- Ammonia Nitrogen:
 - Water Temperature – 29 °C
 - pH – 7.8
- Aquatic Life:
 - Warm Water Habitat for all zones

4.3.2.20 Scioto-Little Walnut Confluence Surface Water Area – 2003 – 2004 Surface Waters Area Characterization

The characterization of the baseline data summarized in **TABLE 4.3.33** and **TABLE 4.3.34** is based on the following:

- For temperature characterization - comparing monthly maximum values with the continuous metering database in the Receiving Waters Metering Baseline Data appendix
- For sediment characterization – comparing the low probability of effect value and the likely probability of effect value in the Ohio EPA sediment quality reference guidelines with the sediment database in the exhibits
- For characterization of all other measures – comparing the numeric values in the current Ohio WQS with the summarized database in the exhibits

Based on the baseline data as summarized in **TABLE 4.3.33** and **TABLE 4.3.34**, the 2003 - 2004 condition of the Scioto River in this surface water area can be characterized as follows:

- Chemistry – Water Column
 - During dry weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met
 - During wet weather, all samples taken of the river in this surface water area were in attainment of numeric values of the current Ohio WQS
 - All chemistry standards were met
- Chemistry – Sediment
 - The streambed sediment in this surface water area appears to contain a level of metals that would indicate a rare occurrence of adverse biological effects from sediment
- Biology
 - The structure of the river in this surface water area appears to be capable of supporting WWH aquatic life designated in the current Ohio WQS
 - The river in this surface water area appears to currently support WWH aquatic life
 - All chemistry standards were met
- Bacteria
 - During dry weather, the river in this surface water area experienced elevated bacteria concentrations which are of concern regarding Primary Contact recreational uses as follows:
 - At the State Route 316 Zone, E. coli concentrations of concern were sampled on August 8, 2004
 - At the Commercial Point Road Zone, fecal coliform concentrations of concern were sampled on August 8, 2004
 - None of the other dry weather E. coli samples contained concentrations of concern.
 - None of the dry weather samples for Fecal coliform contained concentrations of concern.
 - During wet weather and for a period of time after, the river in this surface water area had bacteria concentrations of concern as follows:
 - The fecal coliform and E. coli concentrations measured during all wet weather sampling events were of concern.

4.3.3 Receiving Waters Modeling

This section presents a summary of the water quality modeling effort performed as part of the LTCP process, focusing on application of the model to existing conditions. A full discussion of the water quality modeling tools and process is presented in **APPENDIX G**.

4.3.3.1 Water Quality Modeling Tools

The LTCP water quality modeling tools were developed to simulate the dynamic (i.e., time-varying) response in the City's receiving waters before, during, and after wet-weather events. The following tools were developed:

- A hydrologic model in SWMM RUNOFF, to predict the runoff from tributary watersheds in the project area.
- A hydrodynamic model in SWMM TRANSPORT, to predict the routing of flows through the project receiving waters – Olentangy River, Scioto River, Alum Creek, and Big Walnut Creek.
- A water quality fate and transport model in USEPA WASP, to predict the routing and kinetic transformation of instream pollutants.

4.3.3.2 Parameters of Interest

Based on the assessment of water quality data presented throughout Section 4, it was concluded that the City's CSOs have the potential to affect the following two receiving water quality parameters:

- Bacteria, as indicated by fecal coliform and E. Coli. The data indicates that CSOs consistently contribute to the short-term, highly-elevated bacteria levels that are observed during wet weather. Instream levels measured during these periods are orders of magnitude higher than current recreational standards (as is typical of urban waterways).
- Dissolved oxygen (DO). In general, DO levels in the receiving stream are consistently above applicable water quality standards. However, the continuous DO probes recorded several occurrences of DO levels dropping below 4 mg/l as explained below in Section 4.3.4. Most of these infrequent DO excursions were associated at least in part with dry-weather conditions, so could not have been uniquely impacted by wet-weather CSO discharges. However, because the DO cycle in riverine systems is impacted by processes that can function on a relatively long time scale (i.e., beyond the temporal extent of a single wet-weather event), the possibility that CSOs affect instream DO levels was recognized.

No other water quality parameters were identified as being affected by CSOs. Therefore, the water quality model was developed to predict bacteria levels and DO levels in the receiving streams.

4.3.3.3 Application to ES2005 Conditions

Following calibration, the water quality model was used to simulate the LTCP typical, or average, year under existing conditions. Derivation of the typical year is presented in **APPENDIX J**. The ES2005 simulation was performed as a continuous annual run, and provided predicted instream concentrations for the parameters of interest at 15 minute intervals. The results for bacteria and DO are presented and discussed below.

- Bacteria – **TABLE 4.3.35** summarizes annual hours exceeding the maximum criterion for bacteria for ES2005 at 11 representative locations, on a per month basis. The total number of hours exceeding the maximum criterion for bacteria during the recreation season ranges from 1000 and 1500 for E. Coli, and from 500 and 1000 for fecal coliform. This is consistent with data observations of instream bacteria levels regularly exceeding recreational standards, but is clearly not due uniquely to CSOs. A range of wet-weather sources, measured as part of the monitoring program and included in the model, contribute bacteria loads at levels sufficient to cause instream violation of recreational standards.
- DO - **FIGURE 4.3.12** compares predicted DO levels for the full typical year at four representative locations, including the most critical dam pool in terms of DO (the Main Street Pool), and the most critical river reach in terms of DO (Scioto River at 665). These critical locations were identified during the model calibration effort, as described in *Appendix G*. The abrupt change in the predicted DO series at the quarterly boundaries (i.e. between Q1/Q2, Q2/Q3, and Q3/Q4) is due to the definition of quarterly averages for temperature and solar radiation in the model; in reality, the transition in DO levels would be more gradual. However, the transition values would still be bracketed by the start and end values shown in the predicted quarterly series, so the magnitudes are representative. As can be seen, model predictions indicate that while DO levels can drop below 5 mg/l under certain combinations of environmental conditions, no DO violations will occur in the receiving streams during the typical year. This is consistent with the observed data, which indicate occasional wet-weather sags, but very few DO violations. Those DO violations that do occur are typically associated in part with unique dry-weather conditions.

4.3.4 Water Quality Study

4.3.4.1 Introduction

Using the receiving waters characterizations, this water quality study evaluates the following concerns:

- The 2003 – 2004 water quality impacts that do not appear to be related to issues associated with the existing CSS (i.e. the CSS identified as the Existing System in the Sanitary Sewer System characterization and modeling text of this report)
- The 2003 – 2004 water quality impacts that could be or appear to be related to issues associated with of the Existing System

4.3.4.2 Evaluation of Water Quality during Dry Weather Conditions

For the 2003 – 2004 metering and sampling activities, the process the City used to define dry or wet weather events are contained in the Quality Assurance Project Plan (QAPP), which is included in **APPENDIX C**. The continuous metering equipment was in operation for both the dry and wet weather sampling events and for a period of time before and after the events.

TABLE 4.3.36 lists the five receiving waters dry weather sampling dates as well as the number of non-precipitation dry days (i.e. antecedent dry days) prior to the dry weather sampling events.

Based on the chemical, biological and toxicity summarizations for the 32 sampling zones within the nine surface water areas, dry weather condition of receiving waters of the WWMP planning area can be summarized using:

- Chemical, toxicity, and bacteriological water quality measures listed in **TABLE 4.3.37**.
- The sediment chemistry and Qualitative Habitat Evaluation Index (QHEI) values listed in **TABLE 4.3.38** for non-WQS Ohio guideline numeric values that provide an indication of possible chemical and/or stream bed structural factors that could impair the biology of the receiving waters

Based on an evaluation of the **dry weather data and information** in **TABLE 4.3.37** and **TABLE 4.3.38**, the 2003 – 2004 surface waters conditions *upstream of the CSS* appear to be as follows:

- Olentangy River
- All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS, except:
 - At the Wilson Bridge Road Zone, the temperature maximum was exceeded on May 13 and 14, 2004
 - At the Henderson Road Zone, DO was less than 4 mg/l on August 12, 2004
- All samples taken of the river in this surface water area were in attainment of biological numeric values of the current Ohio WQS
- No samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
- No samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS
- Scioto River
- All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS, except:
 - At the Souder Avenue Zone, DO was less than 4 mg/l on September 14, 2004
 - All other chemistry standards were met
- All samples taken of the river in this surface water area were in attainment of biological numeric values of the current Ohio WQS.
- No samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
- No samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS

- Alum Creek
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - All samples taken of the river in this surface water area were in attainment of biological numeric values of the current Ohio WQS, except:
 - At the Main Street Zone, the IBI was less than 42
 - All other biological standards were met
 - Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS as follows:
 - At the Cleveland Avenue Zone, one of the five dry weather samples caused concern
 - No other fecal coliform samples had concentrations which caused concern
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS as follows:
 - At the Cleveland Avenue Zone, four of the five dry weather samples caused concern
 - At the State Route 3 Zone, two of the five dry weather samples caused concern
 - No other E. coli samples had concentrations which caused concern
- Big Walnut Creek
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - All samples taken of the river in this surface water area were in attainment of biological numeric values of the current Ohio WQS, except:
 - At the Williams Road Zone, the IBI was less than WWH aquatic life score
 - All other biological standards were met
 - No samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS as follows:
 - At the Williams Road Zone, E. coli samples taken on October 23, 2003 and September 7, 2004 caused concern
 - No other E. coli samples had concentrations which caused concern
- Blacklick Creek
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - All samples taken of the river in this surface water area were in attainment of biological numeric values of the current Ohio WQS, except:
 - At the Winchester Pike Zone, the Index of Well Being was slightly less than WWH aquatic life score

- All other aquatic life criteria were met
- No samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
- Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS as follows:
 - At the Winchester Pike Zone, three E. coli samples caused concern in 2004

Based on an evaluation of the **dry weather data and information** in **TABLE 4.3.37** and **TABLE 4.3.38**, the 2003 – 2004 surface waters conditions *within the CSS* appear to be as follows:

- Olentangy River
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - All samples taken of the river in this surface water area were in attainment of biological numeric values of the current Ohio WQS
 - No samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS as follows:
 - At the State Route 33 Zone, E. coli samples taken during all dry weather events caused concern
 - Two to three E. coli samples were taken at the other zones which caused concern
- Scioto River
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS, except:
 - At the Broad Street Zone, DO was less than 3 mg/l on August 18, 2004
 - At the Town Street Zone, DO was less than 3 mg/l on August 18, 2004
 - At the State Route 104 Zone, DO was less than 4 mg/l on August 13, 2004 and on August 14, 2004
 - At the Jackson Pike Zone, DO was less than 4 mg/l on August 14, 2004
 - All other chemistry standards were met
 - All samples taken of the river in this surface water area were in attainment of biological numeric values of the current Ohio WQS
 - No samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS.
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS
 - At the State Route 104 Zone, samples of concern were taken on August 8, 2004 and on August 17, 2004

- Alum Creek
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - All samples taken of the river in this surface water area were in attainment of biological numeric values of the current Ohio WQS, except:
 - At the Livingston Avenue Zone, the IBI was slightly less than WWH aquatic life score
 - All other aquatic life criteria were met
 - No samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS.
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS as follows:
 - Three E. coli samples were taken which would cause concern at both zones

Based on an evaluation of the **dry weather data and information** in **TABLE 4.3.37** and **TABLE 4.3.38**, the 2003 – 2004 surface waters conditions *downstream of the CSS* appear to be as follows:

- Scioto River
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - All samples taken of the river in this surface water area were in attainment of biological numeric values of the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS as follows:
 - The I-270 Zone and the State Route 762 Zone had samples with concentrations that caused concern during four of the five dry weather sampling events
 - The State Route 665 Zone had samples with concentrations that caused concern during all dry weather sampling events
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS as follows:
 - The I-270 Zone, the State Route 665 Zone and the State Route 762 Zone had samples with concentrations that caused concern during all dry weather sampling events
- Alum Creek
 - Except for the lower part of Alum Creek, All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - All samples taken of the river in this surface water area were in attainment of biological numeric values of the current Ohio WQS, except:
 - Fish community of lower Alum Creek slightly less than IBI value in the current Ohio WQS

- All other aquatic life criteria were met
- No samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
- No samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS
- Big Walnut Creek
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - All samples taken of the river in this surface water area were in attainment of biological numeric values of the current Ohio WQS
 - No samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS as follows:
 - The Reese Road Zone, had samples with concentrations that caused concern during the August 17, 2004 dry weather sampling event
 - No other E. coli samples caused concern

4.3.4.3 Evaluation of Water Quality during Wet Weather Conditions

For the 2003 – 2004 metering and sampling activities, the process the City used to define dry or wet weather events are contained in the QAPP, which is included in **APPENDIX C**. The continuous metering equipment was in operation for both the dry and wet weather sampling events and for a period of time before and after the events.

Two distinct types of wet weather sampling occurrences are contained in the receiving waters sampling baseline data appendix. Any antecedent precipitation under 0.05 inches is not counted as precipitation when determining the amount of antecedent dry days. While a couple of events came right after one another, the City attempted to space its wet weather events with at least 3 antecedent days of zero precipitation.

Those two types of wet weather sampling occurrences are as follows:

- Wet weather sampling events – sampling events that spanned several days in order to collect samples of the receiving waters conditions before, during and after a precipitation event
- Wet weather sampling days – sampling events that occurred on only a single day *in order to collect samples of the receiving waters conditions before, during and after a precipitation event*

TABLE 4.3.39 lists the receiving waters wet weather sampling events as well as the number of days without precipitation (i.e. antecedent dry days) prior to the wet weather sampling events.

TABLE 4.3.40 lists the receiving storm water sampling days as well as the number of days without precipitation (i.e. antecedent dry days) prior to the storm water sampling days.

Based on the above summarizations and the baseline data underlying the above summarizations, the wet weather conditions of receiving waters can be characterized using the number of water quality measures and types effected by wet weather conditions and those measures that exceeded current Ohio WQS. **TABLE 4.3.41** summarizes the lists the number of measures and types that exceeded current Ohio WQS during wet weather conditions.

Based on an evaluation of the **wet weather data and information** in **TABLE 4.3.41**, the 2003 – 2004 surface waters conditions *upstream of the CSS* appear to be as follows:

- Olentangy River
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS
- Scioto River
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS
- Alum Creek
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS, except:
 - At the Cleveland Avenue, State Route 3 and Mock Road zones, Copper was exceeded during on July 12, 2004, September 8, 2004 and September 9, 2004
 - All other chemistry standards were met
 - Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS
- Big Walnut Creek
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS, except:
 - At the Reese Road Zone, DO was less than 5 mg/l on July 12, 2004
 - All other chemistry standards were met
 - Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS

■ Blacklick Creek

- All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS, except:
 - At the Winchester Pike Zone, DO was less than 4 mg/l on September 8, 2004
 - All other chemistry standards were met
- Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
- Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS

Based on an evaluation of the **wet weather data and information** in **TABLE 4.3.41**, the 2003 – 2004 surface waters conditions *within the CSS* appear to be as follows:

■ Olentangy River

- All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS, except:
 - At the State Route 33 Zone, DO was less than 3 mg/l on August 28, 2004
 - All other chemistry standards were met
- Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
- Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS

■ Scioto River

- All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS, except:
 - At the Broad Street and Town Street State zones, DO was less than 3 mg/l on August 20, 2004 after CSS discharges on August 19, 2004 from the Third Avenue, Indianola Avenue, Frambes Avenue, Doe Alley and Hudson Street CSOs
 - At the Jackson Pike Zone, DO was less than 4 mg/l on July 11 and 12, 2004 before and during CSS discharges from multiple upstream discharge points, on July 13 and 14, 2004 after CSS discharges from multiple discharge points and on September 8, 2004 before and during a CSS discharges from the Whittier Street Storm Standby Tanks
 - All other chemistry standards were met
- Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
- Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS

■ Alum Creek

- All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS

- Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
- Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS

Based on an evaluation of the **wet weather data and information** in **TABLE 4.3.41**, the 2003 – 2004 surface waters conditions *downstream of the CSS* appear to be as follows:

- Scioto River
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS
- Alum Creek
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS
- Big Walnut Creek
 - All samples taken of the river in this surface water area were in attainment of chemical numeric values of the current Ohio WQS, except:
 - At the Reese Road Zone, DO was less than 5 mg/l on July 12, 2004
 - All other chemistry standards were met
 - Some samples that would cause concern with attainment of the 30-day fecal coliform geometric mean numeric value in the current Ohio WQS
 - Some samples that would cause concern with attainment of the 30-day E. coli geometric mean numeric value in the current Ohio WQS

4.3.4.4 Analysis of Dry Weather DO Exceedances

The DO exceedances during the 2003 –2004 dry weather sampling occurred in the following zones:

- The Jackson Pike Zone, the zone immediately downstream of the most significant existing CSOs but immediately upstream of the Jackson Pike Outfall 001
- The adjacent State Route 33 Zone (Olentangy River), the Souder Avenue Zone, the Broad Street Zone and the Town Street Zone, the four upstream zones of the five zones in the Main Street Dam impoundment

The observed 2003 –2004 dry weather DO exceedances appear to happen when a WWMP surface water was transitioning to or from dry weather flow conditions in response to a precipitation-generated stream flow condition marking the end of an extended dry weather condition. The observed dry weather DO exceedances generally occurred mostly in the morning hours following the onset of wet weather conditions and following the end of a precipitation event.

It appears that, during the transition to wet weather stream flow conditions from dry weather flow conditions, all the WWMP surface waters appear to experience a great increase in turbidity concurrent with an increase in flow rate. Similarly, during the transition from wet weather stream flow conditions to dry weather flow conditions, all the WWMP surface waters appear to experience a great decrease in turbidity concurrent with a decrease in flow rate. The turbidity continuous data plots contained in **APPENDIX E** illustrate these apparent trends for all the WWMP surface waters. The turbidity continuous data plots also appear to show a great increase in turbidity concurrent with an increase in flow rate.

These apparent changes in turbidity and flow rate, instream algae (as measured by chlorophyll-a) appear to change concurrently, the timing of the change appears to occur when algae is consuming DO approaching or during nighttime. During dry weather, instream chlorophyll-a concentrations appear to trend upward with each succeeding day of dry weather that appears to cause a resulting larger oscillation in the maximum and minimum concentrations in the diurnal DO pattern. This apparent trend is shown in the chlorophyll-a and DO continuous data plots contained in the Receiving Waters Metering Baseline Data appendix. When flow rate increases after a dry weather period, the chlorophyll-a concentrations appear to trend quickly down to some relatively stable level that is quickly followed by a similar decrease in the maximum and minimum concentrations in the diurnal DO pattern.

It is possible that the timing and volume of any CSS discharge residual in the CSS receiving waters could act in conjunction with the observed adverse DO impacts that appear to result from sediment and gradual algal fluctuations in the WWMP surface waters. Through the dry weather and wet weather simulations of the Receiving Waters model for existing conditions, the relative importance of these factors will be better understood for purposes of analysis.

4.3.4.5 Analysis of Dry Weather Bacteriological Exceedances

The bacteriological samples which had concentrations that caused concern about attainment of the 30-day geometric mean numeric value during dry weather sampling events occurred in the following zones:

- Several dry weather Fecal coliform samples of concern were taken primarily during extended dry weather events in the zones having a major wastewater treatment plant discharge within several upstream river miles
- Numerous dry weather E. coli samples of concern were taken during extended dry weather events throughout all zones having freely flowing surface waters

When evaluating the 2003 – 2004 dry weather sampling data, a general indication of the instream bacteria counts appears to be best provided by the bacteria counts immediately downstream from major impoundments. During the 2003 – 2004 dry weather sampling, no dry

weather bacteriological samples of concern were taken at the Souder Avenue Zone, the Broad Street Zone, the Town Street Zone, the Main Street Zone, the Greenlawn Avenue Zone, the State Route 104 Zone (Alum Creek) or the Williams Road Zone (Alum Creek). The only freely flowing zones for which there were no dry weather bacteriological samples of concern were the Mock Road Zone (Alum Creek) and the Rowe Road Zone (Big Walnut Creek).

4.3.4.6 All Other Dry Weather Exceedances of Chemical Ohio WQS

Of the more than 25 water column chemical measures analyzed in the five 2003 – 2004 dry weather sampling events for 31 zones, only one chemical exceedance of Ohio WQS other than DO was observed. That exceedance was a temperature maximum exceedance at the Wilson Bridge Road Zone, the upstream-most zone on the Olentangy River. The temperature maximum exceedance occurred in May 2004. For the thirty second zone, the I-70 Zone, no chemistry samples were collected due to site access limitations.

4.3.4.7 Analysis of 2003 –2004 Wet Weather Sampling Events

TABLE 4.3.42 lists the CSS discharges and volumes that occurred during the six 2003 – 2004 wet weather sampling events. **TABLE 4.3.43** lists the Southerly Bypass discharges that occurred during those wet weather sampling events.

Other CSS discharges occurred during 2004 precipitation events during which a wet weather sampling events did not occur. The following list identifies the CSS discharge points that activated in April 2004 through October 2004 during which wet weather sampling did not occur.

- Markison Avenue - May 17, May 21, May 31, June 11, June 14, July 17, July 22, August 20, August 26 and August 28, 2004
- Moler Street - May 17, May 18, May 21, June 11, June 14, July 17, July 22, August 20, August 26 and August 28, 2004
- Whittier Street Storm Standby Tanks – April 1, April 12, April 13, April 22, May 2, May 15, May 18, May 21, May 31, June 11, June 15, July 16, July 17, July 22, July 26, August 19, August 21, August 26, September 17, and October 24, 2004
- Whittier Street - April 22, May 17, May 18, May 21, June 11, June 14, July 16, July 17, July 22, August 20, August 26 and August 28, 2004
- Liberty Street (Peters Run) - May 17, May 18, May 19, May 21, June 11, July 17, August 20 and August 28, 2004
- Mound Street and Grant Avenue - April 2, April 8, April 12, April 13, April 20, April 21, April 22, April 24, April 26, May 7, May 12, May 27, May 30, June 1, June 9, June 11, June 12, July 16, July 17, July 22, July 26, August 4, August 15, August 19 and September 17, 2004
- Noble Street and Grant Avenue - April 22, May 7, May 17, May 18, May 19, May 21, May 27, May 30, June 1, June 9, June 11, June 12, June 13, June 15, June 17, July 16, July 17, July 22, July 26, August 4, August 15, August 19, August 20, August 25, August 26, August 28, September 17, October 15 and October 23, 2004

- Town and Fourth Streets - April 8, April 12, April 13, April 20, April 21, April 22, April 25, May 7, May 11, May 12, May 15, May 17, May 18, May 19, May 21, May 27, May 31, June 1, June 9, June 11, June 12, June 13, June 15, June 17, July 16, July 17, July 22, July 26, August 4, August 15, August 19, August 20, August 21, August 25, August 26, August 28, September 17, October 15, October 23 and October 27, 2004
- Cherry and Fourth Streets - April 8, April 12, April 13, April 20, April 22, April 25, May 7, May 11, May 12, May 17, May 18, May 19, May 21, May 27, May 30, May 31, June 1, June 9, June 11, June 12, June 13, June 15, June 17, July 16, July 17, July 22, July 26, August 4, August 15, August 19, August 20, August 25, August 26, August 28, September 17, October 15, October 23 and October 27, 2004
- Noble and Fourth Streets - May 7, May 17, May 18, May 19, May 21, May 31, June 11, June 13, June 15, July 17, August 26 and August 28, 2004
- Mound Street east of Interstate 71 - May 21 and June 11, 2004
- Dodge Park – (none)
- Broad Street - May 21, June 11, July 16, July 17, July 22 and August 28, 2004
- Long Street - May 21, June 11, June 15, July 16, July 17, July 22 and August 28, 2004
- Kerr and Russell Streets - April 22, May 7, May 11, May 12, May 18, May 21, May 31, June 9, June 11, June 12, June 13, June 15, June 17, July 16, July 17, July 22, July 26, August 4, August 19, August 20, August 21, August 24, August 25, August 26, August 28, September 17, October 15, October 18 and October 23, 2004
- Chestnut Street - May 21, June 11, June 15, July 16, July 17, July 22, August 19 and August 28, 2004
- Henry Street - May 21, June 11, July 16, July 22, August 19 and August 28, 2004
- First Avenue - May 21, June 11, July 17, July 22, 2004
- Third Avenue - May 21, June 11, July 16, July 17, July 22 and August 19, 2004
- King Avenue - May 21, June 11, July 17 and July 22, 2004
- Indianola Avenue - May 21, June 11, June 15, July 17, July 22 and August 19, 2004
- Frambes Avenue - May 21, June 11, July 17, July 22 and August 19, 2004
- Doe Alley - May 21, June 11, July 17, July 22 and August 19, 2004
- Hudson Street - May 21, May 31, June 11, June 13, June 14, July 17, July 22 and August 19, 2004

To determine the significance of the six 2003 –2004 wet weather sampling events, **TABLE 4.3.44** compares the number of activations and activation volumes with the number of activations and activation volumes predicted by the 2005 Existing System (2005 ES) Storm Water Management Model (SWMM) for the 2nd quarter, 3rd quarter and 4th quarter for the typical year precipitation pattern. The 2003 –2004 metering and sampling events occurred during October and November of 2003 (i.e. approximately the 4th quarter of a calendar year) and April through October of 2004 (i.e. the 2nd quarter and 3rd quarter of a calendar year).

On a systemwide basis, the total volume of discharges from the combined sewer system during the 2003 – 2004 Metering and Sampling Events was 563 MG. The total volume of discharges predicted by the 2005 ES SWMM for the 2nd quarter, 3rd quarter and 4th quarter for the typical year precipitation pattern is approximately 868 MG.

TABLE 4.3.45 identifies as a percentage the number of activations sampled versus the number of activations predicted by the 2005 ES SWMM for the 2nd quarter, 3rd quarter and 4th quarter for the typical year precipitation pattern.

On a systemwide basis, the percentage of total volume of discharges by the 2005 ES SWMM for the 2nd quarter, 3rd quarter and 4th quarter versus the total volume of discharges sampled during the 2003 – 2004 Metering and Sampling Events is approximately 65%. This high percentage demonstrates that the sampling performed was highly representative of the systemwide CSOs that are predicted to occur for a typical year.

4.3.4.8 Analysis of Wet Weather DO Exceedances

As shown in **TABLE 4.3.41**, the wet weather characterization of the receiving waters in the WWMP planning area can be summarized as follows:

- Except for DO, it is probable that any precipitation event upstream, within or downstream of the CSS will not cause the receiving waters to exceed the chemical numeric values in the current Ohio WQS
 - While significant depression of instream DO was not observed for each and every CSO discharge and, further, was observed at several zones not receiving CSS discharges, CSOs during those wet weather events may or may not have added sufficient oxygen demanding materials to the CSS receiving waters to create the observed depression of instream DO at the Broad Street Zone, the Town Street Zone and the Jackson Pike Zone along the Scioto River and the State Route 104 Zone along Alum Creek
- It is probable that any precipitation event upstream, within or downstream of the CSS is likely to cause the WWMP surface waters to exceed the 30-day Fecal coliform geometric mean numeric value in the current Ohio WQS
- It is probable that any precipitation event upstream, within or downstream of the CSS is likely to cause the WWMP surface receiving waters to exceed the 30-day E. coli geometric mean numeric value in the current Ohio WQS

4.3.4.9 Analysis of Wet Weather Bacterial Concentrations

The wet weather sampling database indicates all the river reaches of interest for this report experienced elevated bacteria concentrations both during and immediately after significant precipitation events. These levels may cause concern about their possible contribution to a statistical water quality standard exceedance. These elevated levels are clearly illustrated by the sampling results for the September 8 - 11, 2004 wet weather event. This event was essentially preceded by 10 dry days and followed by at least 6 dry days. The sanitary sewer system metering data indicates that no activation of the Whittier Street Storm Standby Tanks discharge point or

any other CSO appears to have occurred during the 10 antecedent days and for 6 days after the event.

Besides activation of the Whittier Street Storm Standby Tanks discharge point on September 8, 2004 between 12:50 p.m. and 1:20 p.m., **TABLE 4.3.46** shows that there could have been several SSO discharges occurring during the September 8 - 11, 2004 wet weather event according to the monthly SSO reporting log sheets. Any SSO discharge during the September 8 - 11, 2004 wet weather event would have been in addition to the CSO that occurred at the Whittier Street Storm Standby Tanks.

During the September 8 - 11, 2004 wet weather event, the Whittier Street Storm Standby Tanks discharged 23.6 MG between 12:50 p.m. on September 8, 2004 and 1:20 a.m. on September 9, 2004.

FIGURE 4.3.13 presents 13 logarithmic charts showing the E. coli counts at the Scioto River zones before and during the September 8 - 11, 2004 wet weather event. No E. coli data or any chemistry data was collected at the I-70 Zone due to site access limitations.

Given the 30-day geometric mean WQS standard for E. coli of 126 counts/100 ml, the thirteen logarithmic graphs of **FIGURE 4.3.13** show:

- The areas of Scioto River zones where E. coli concentrations greater than 1000 cfu/ml were measured after 10 antecedent dry days, creating concern about their possible contribution to a statistical exceedance of the 30-day standard.
- The significant elevation of E. coli concentrations at the four Scioto River zones upstream of the Whittier Street Storm Standby Tanks during the September 9 – 11, 2004 wet weather event even though no CSO discharges occurred except at the Whittier Street Storm Standby Tanks
- The further increase of E. coli concentration at the eight Scioto River zones downstream of the Whittier Street Storm Standby Tanks during the September 9 – 11, 2004 wet weather event due to the CSO discharges that occurred at the Whittier Street Storm Standby Tanks
- The transport of the increased concentration of E. coli through the eight Scioto River zones downstream of the Whittier Street Storm Standby Tanks during the September 9 – 11, 2004 wet weather event during and following the CSO discharges that occurred at the Whittier Street Storm Standby Tanks
- The nearly complete recovery and the beginning of return to pre-precipitation conditions two days after the cessation of the CSO discharges that occurred at the Whittier Street Storm Standby Tanks

The September 9 – 11, 2004 wet weather event is significant since it clearly demonstrates the increased bacteria concentration due to CSO discharges from the Whittier Street Storm Standby Tanks. The thirteen logarithmic graphs of **FIGURE 4.3.13** appear to indicate that downstream E. coli during the September 9 – 11, 2004 wet weather event were elevated by approximately two magnitudes during the height of the bacterial discharge from the CSO from the Whittier Street Storm Standby Tanks. The Receiving Waters metering and sampling baseline data shows similar but less pronounced patterns discernable in the receiving waters during CSO

discharges at the other CSS discharge locations during the wet weather sampling events those other discharges activated.

4.3.5 Sensitive Areas Considerations

4.3.5.1 Introduction

Based on the use designation of Primary Contact Recreation, all the receiving waters within the study area are sensitive areas. To enable useful prioritization of sensitive areas, the five categories of sensitive area listed in the CSO Consent Order, Section 12.C.1, are used, below. In addition, the category “Receiving waters having immediate access from public areas” has also been included to effectuate an obvious purposes of the sensitive area provision - that of identifying the likelihood of public interaction with the receiving water. Public interaction is more likely in public recreation areas, such as parks or bike trails. Therefore, the following six use types are considered as “sensitive areas”:

- **Receiving waters having designated special water qualities** - surface waters currently designated as *General high quality waters*, *Superior high quality waters*, *Outstanding state waters* or *Outstanding national resource waters* as defined and identified in Chapter 3745-1-05 of the Ohio Administrative Code (OAC) and as identified as *State Resource Waters (SRW)* in Chapter 3745-1-09 of the OAC
- **Receiving waters having designated high recreational use** - Surface waters currently having a primary contact recreational use designation as defined in Chapter 3745-1 -07(B)(4) of the OAC and as identified as *Primary Contact Recreation* in Chapter 3745-1-09 of the OAC
- **Receiving waters adjacent to swimming beaches** - Bathing Waters currently as defined in Chapter 3745-1 -07(B)(4) of the OAC
- **Receiving waters having immediate access from public areas** - Surface waters currently immediately adjacent to existing publicly owned parks and/or to existing publicly owned trails
- **Receiving waters designated as public water supplies** - Surface waters currently within 500 yards of an existing public water supply intake as defined in Chapter 3745-1 -07(B)(3) (iii) of the OAC and as identified as *Public Water Supply (PWS)* in Chapter 3745-1-09 of the OAC
- **Receiving waters having special biological attributes** - Surface waters currently supporting declining fish species defined in Chapter 3745-1 –05(A)(5) of the OAC, endangered species defined in Chapter 3745-1 –05(A)(26) of the OAC and/or threatened species and/or other shellfish

Since the Upper Olentangy Surface Waters Area and the Upper Alum Creek Surface Waters Area are upstream of the CSS, sensitive areas within these two surface waters areas are not included in this consideration.

4.3.5.2 Identification of Receiving Waters having Designated Special Water Qualities

TABLE 4.3.47 lists the receiving waters having special water quality designations.

4.3.5.3 Identification of Receiving Waters having Designated High Recreational Use

In general, all receiving waters in the nine receiving waters characterization surface waters areas can be considered sensitive areas based on the current *Primary Contact Recreation* designations in Chapter 3745-1-09 of the OAC and application of the *designated high recreational use* sensitive area definition. Primary contact recreation use designation is one of the defined sensitive areas in paragraph 12.C.1) of the CSO Consent Order.

Therefore, the existing CSS could impair high recreational use of any of the seven receiving waters characterization surface waters areas. Two of the surface waters areas, the Upper Olentangy Surface Waters Area and the Upper Alum Creek Surface Waters Area, are upstream of the CSS.

4.3.5.4 Identification of Receiving Waters Adjacent to Swimming Beaches

None of the receiving waters are adjacent to officially designated and/or dedicated swimming beaches.

4.3.5.5 Identification of Receiving Waters having Immediate Public Access

All surface water areas in the CSS planning area have almost unrestricted access through public and private areas. The only access limitations would be due to parcels of public or private property being as follows:

- Total restriction of public access such as the secured sites of the two Columbus wastewater treatment plants
- Impaired public access such as the east bank of the Scioto River between Broad Street and Main Street

TABLE 4.3.48 and **TABLE 4.3.49** lists publicly owned park areas, park-like areas and/or bike paths/trails immediately adjacent to the CSS receiving waters. These areas, therefore, provide almost immediate public access to the CSS receiving waters. Both exhibits list the information in an upstream to downstream direction.

4.3.5.6 Identification of Receiving Waters Designated as Public Water Supplies

TABLE 4.3.50 lists the receiving waters having special water quality designations.

4.3.5.7 Identification of Receiving Waters having Special Biological Attributes

TABLE 4.3.51 lists the six freshwater mussels identified in the *2004 Freshwater Mussels Survey Report* as being species of concern, endangered species or threatened species in the State of Ohio. **TABLE 4.3.52** lists the receiving waters with special fish identified in the *2005 Bioassessment of Selected Columbus Area Streams*. The 2005 bioassessment is contained in the Receiving Waters Sampling Baseline Data appendix.

+ + END OF SECTION + +

TABLE 4.1.1: Combined and Separate Sewers and Corresponding Sub-Areas		
Sewer Type	Area Name	Description
Combined Sewer	Olentangy Scioto Interceptor Sewer (OSIS) Combined Tributary Area	This sub-area includes tributary areas to the OSIS from the Hudson street regulator to the Whittier Street Storm Tanks Control House.
Separate Sanitary Sewer	Olentangy Scioto Interceptor Sewer (OSIS) Separate Tributary Area	This sub-area includes all separate sanitary system areas tributary to the OSIS upstream of the combined sewer system. Main trunk sewers in this area include: Clintonville Main Trunk Sanitary Sewer, Olentangy Main Trunk Sanitary Sewer, Beulah Road. Trunk Sewer, Clinton #3 Trunk Sewer, Kinnear Road Sub-sewer, and the OSIS upstream of the Hudson Street Regulator.
	Jackson Pike Tributary Area	This sub-area includes all trunk sewers tributary to the OSIS downstream of the Whittier Street Storm Tanks Control House to the Jackson Pike WWTP. These trunk sewers are the Scioto Main Trunk Sewer, West Side Sanitary Sewer, West Side Relief Sewer, Franklin Main Interceptor Sewer, Alum Creek Interceptor Sewer (Deshler Tunnel), and the Castle Road Pump Station (now connected to the Scioto Main).
	Interconnecting Sewer Tributary Area	This sub-area includes the Big Run Sanitary Trunk Sewer, Williams Road Pump Station, and the Grove City sewers. During dry weather flow, the Big Run Sanitary Trunk Sewer and the Williams Road Pump Station flows are directed to the Jackson Pike WWTP. During wet-weather flow, excess flows beyond the capacity of the Jackson Pike WWTP are directed to the Southerly WWTP through the Interconnecting Sanitary Sewer.
	Big Walnut Creek Tributary Area	This sub-area includes the flow from the east side of the collection system. Main trunk sewers include: Alum Creek Area Trunk Sewer, Big Walnut Sanitary Trunk Sewer, Blacklick Creek Trunk Sewer, and Big Walnut Sanitary Outfall Sewer.

*Cozzins St. regulator is scheduled to be taken out of service in 2005.

TABLE 4.1.2: Identified CSOs in the City of Columbus

CSO Name	Overflow type	2005 Draft NPDES Permit CSO discharge point
Hudson Street	Regulator	4PF00000004
Doe Alley	Regulator	4PF00000031
Frambes Avenue	Regulator	4PF00000005
Indianola Avenue	Regulator	4PF00000006
King Avenue	Regulator	4PF00000007
Third Avenue	Regulator	4PF00000027
First Avenue	Regulator	4PF00000032
Henry Street	Regulator	4PF00000028
Chestnut Street	Regulator	4PF00000010
Spring Street	Regulator	4PF00000011
Long Street	Regulator	4PF00000012
Broad Street	Regulator	4PF00000017
Capital Street	Manhole	4PF00000013
State Street	Manhole	4PF00000014
Town Street	Regulator	4PF00000015
Rich Street	Regulator	4PF00000016
Kerr Street and Russel Street	Manhole	4PF00000049
Dodge Park Combined P.S.	Pump station	4PF00000048
Mound Street e/o Interstate 71	Manhole	4PF00000042
Noble Street and 4 th Avenue	Manhole	4PF00000046
Cherry Street and 4 th Avenue	Manhole	4PF00000045
Town Street and 4 th Avenue	Manhole	4PF00000047
Noble Street and Grant Avenue	Manhole	4PF00000043
Mound Street and Grant Avenue	Manhole	4PF00000041
Peter's Run	Regulator	4PF00000044
Whittier Street	Regulator	4PF00000033
Moler Street	Regulator	4PF00000020
Markison Avenue	Regulator	4PF00000029
Whittier Street Storm Stand-by Tanks	Storage tanks	4PF00000018
Whittier Street Storm Stand-by Tanks Bypass	Storage tanks	4PF00000019
Cozzins Street*	Regulator	4PF00000008
Alum Creek Storm Tanks	Storage tanks	4PF00001006

TABLE 4.1.3: Key Sluice Gates Configuration*

Item	Description	Type	Depth (feet)	Width (feet)
1	Gate inside Hudson Street Regulator to OSIS	Rectangular	0.9	2
2	Gate inside Doe Alley Street Regulator to OSIS	Circular	1.5	N/A
3	Gate inside Frambes Road Regulator to OSIS	Rectangular	1.8	4
4	Gate inside Indianola Avenue Regulator to OSIS	Rectangular	2.61	4.5
5	Gate inside King Avenue Regulator to OSIS	Rectangular	1.3	2
6	Gate inside Third Avenue Regulator to OSIS	Rectangular	2.4	4
7	Gate inside First Avenue Regulator to OSIS	Circular	1.25	N/A
8	Gate inside Henry Street Regulator to OSIS	Rectangular	1.3	6
9	Gate to Chestnut Street Chamber	Rectangular	4	4
10	Gate inside Chestnut Street Regulator to OSIS.	Rectangular	2	5.5
11	Gate inside Spring Street Regulator to OSIS	Circular	1.9	N/A
12	Gate inside Long Street Regulator to OSIS	Rectangular	1.65	2.5
13	Gate inside Broad Street Regulator to OSIS	Rectangular	2.95	2.5
14	Gate inside Town Street Regulator to OSIS	Rectangular	2.16	2.5
15	Gate inside Rich Street Regulator to OSIS	Circular	2.1	N/A
16	Gate inside Peters Run Regulator to OSIS	Rectangular	4	4
17	Gate inside Whittier Street Regulator to OSIS	Rectangular	1.6	3
18	Gate inside Moler Street Regulator to OSIS	Rectangular	1.5	3
19	Gate inside Markison Street Regulator to OSIS	Rectangular	1.7	2.5
20	Gate inside Cozzins Street Regulator to OSIS	Rectangular	N/A	1.3
21	Two Gates inside the Alum Creek Storm Tank Control House to regulate flow to the Alum Creek Interceptor Sewer	Rectangular	0.65	4
22	Three sets of four sluice gates from OSIS to Whittier Tanks. These gates are time controlled	Rectangular	4	4
23	Emergency bypass gates (three gates) inside Whittier Tanks control house, time controlled.	Rectangular	5	4
24	Gate inside the Flow Control Structure to regulate flow from Jackson Pike WWTP into the Interconnecting Sanitary Trunk Sewer, time controlled.	Rectangular	8	4
25	Two gates inside Whittier Street Storm Tanks Control House to regulate flow from OSIS to Jackson Pike WWTP. There are two gates but only one is used at a time while the other remains closed.	Rectangular	3	4
26	Gate inside the Flow Diversion Structure to regulate flow into Jackson Pike WWTP	Rectangular	8	4
27	Two gates inside the Flow Diversion Structure to regulate flow from Jackson Pike WWTP to the Interconnecting Sanitary Trunk Sewer	Rectangular	8	6
28	Three gates inside the Grit Chamber to regulate flow in OSIS. Gates are time controlled.	Rectangular	6	4.5
29	Gate inside the Vortex Control Structure on Scioto Main Trunk Sewer to regulate flow from Scioto Main Basin to Jackson Pike WWTP. Gate is throttled to 36" to allow for using the 9-foot SCM for storage	Circular	3	N/A
30	Gate to Williams Road pump station wet well.	Circular	4	N/A

* Data based on January, 2005 conditions

N/A = Not applicable or not available

TABLE 4.1.4: Key Weirs and Relief Pipes Configuration*

ID	Description	Weir Crest Above Invert (ft)	Weir Length (ft)
1	Relief weir from Clintonville Main Sanitary Trunk Sewer to Franklin Main Interceptor Sewer	2.55	2
2	Overflow weir inside Hudson Street Regulator	7.4	15
3	Overflow weir inside Doe Alley Street Regulator	6	9
4	Overflow weir inside Frambes Street Regulator	8	50
5	Overflow weir inside Indianola Avenue Regulator	9.9	57.4
6	Overflow weir inside King Avenue Regulator	7.51	15
7	Overflow weir inside Third Avenue Regulator	10.06	71
8	Overflow weir inside First Avenue Regulator	7.3	10
9	Overflow weir inside Henry Street Regulator	11.5	109
10	Overflow weir located at the junction of the 72-inch connection pipe from the Randolph Street Sewer and the Chestnut Street Regulator Chamber	1.67	7.12
11	Overflow weir inside Chestnut Street Regulator	13.5	97.92
12	Overflow weir inside Spring Street Regulator	12.92	26
13	Overflow weir inside Long Street Regulator	12.21	20
14	Overflow weir inside Broad Street Regulator	14.72	44
15	Overflow weir inside Town Street Regulator	13.83	44
16	Overflow weir inside Rich Street Regulator	14.35	26
17	Overflow weir inside Peters Run Regulator	13.33	92
18	Overflow weir inside Whittier Street Regulator	10.99	36
19	Overflow weir inside Moler Street Regulator	9.04	20.5
20	Overflow weir inside Markison Street Regulator	4.97	22.7
21	Overflow pipe inside Capital Street	14.25	N/A
22	Overflow pipe inside State Street	12.82	N/A
23	Overflow pipe inside Cozzins Street Regulator	3.5	6
24	Weir downstream of Markison Avenue Regulator to split flow between two receiving sewers that ultimately discharge into South Side Sanitary Sewer	1.06	6
25	Window in a special gate along Alum Creek Interceptor Sewer (ACIS). This structure diverts dry weather flow from ACIS to Alum Creek Area Trunk Sewer. WWF can be relieved to Deshler Tunnel.	3.38	3
26	Overflow weir inside Alum Creek Storm Tank to Alum Creek.	10.03	106
27	Relief weir from Alum Creek Area Trunk Sewer To ACIS/Deshler Tunnel (Partially blocked relief pipe)	2.25	3
28	Relief from Alum Creek Combined Area to Chestnut Street Regulator Basin	2.6	18
29	Overflow weir inside Whittier Street Storm Tank	8.12	315
30	Emergency overflow inside Whittier Tanks Control House	23.95	21
31	Grit Chamber weir along OSIS	9.5	16
32	Bypass weir from Jackson Pike WWTP to an overflow pump station	13.21	8
33	Weir inside the Flow Control Structure to divert Big Run Basin dry weather flow to Jackson Pike WWTP	6.5	12.5
34	Bypass weir from Southerly WWTP	11.61	26
35	Relief connection from Scioto Main Trunk Sewer to West Side Sanitary Sewer	4.65	

* Data based on January, 2005 conditions

TABLE 4.1.5: Separate Sanitary Areas Tributary to the OSIS Upstream of the Combined Sewer Area				
	Trunk Sewer Name	Served Area (acres)	Unserved Area (acres)	Total Area (acres)
1	Clintonville Main Trunk Sanitary Sewer	2,714	418	3,132
2	Olentangy Main Trunk Sanitary Sewer	9,554	5072	14,626
3	Beulah Road. Trunk Sewer	2,457	520	2,977
4	Clinton #3 Trunk Sewer	4,271	1,697	5,968
5	Kinnear Road Trunk Sewer	489	47	536
6	OSIS between Clintonville and Hudson Street Regulator	1,081	120	1,201
7	Franklin Main Interceptor Sewer (Upstream 2 nd Avenue P.S.)	1,486	423	1,909
	Total	22,052	8,297	30,349

TABLE 4.1.6: Satellite Collection Systems Tributary to the City of Columbus' Sewer		
Satellite Collection System	Area (acres)	Area (square miles)
Bexley	1566.1	2.45
Brice	51.4	0.08
Dublin	16922.7	26.44
Gahanna	11839.1	18.50
Grandview Heights	852.0	1.33
Grove City	16787.9	26.23
Groveport	8158.3	12.75
Hilliard	11476.5	17.93
Lockbourne	66.5	0.10
Marble Cliff	177.5	0.28
Minerva Park	418.6	0.65
New Albany	8078.6	12.62
Obetz	5146.6	8.04
Reynoldsburg	10179.4	15.91
Riverlea	99.9	0.16
Shawnee Hills	426.5	0.67
Upper Arlington	6296.2	9.84
Urbancrest	272.1	0.43
Valleyview*	95.0	0.15
Westerville	10351.9	16.17
Whitehall	3631.5	5.67
Worthington	3497.6	5.46
Total	120,910.4	188.9

*Valleyview is considered a satellite area, but contracts with the City of Columbus for maintenance service in a portion of their area

TABLE 4.1.7: Franklin County Satellite and Maintenance Areas Tributary to the City of Columbus' Sewer System

Service Area	Agreement Type	Area (acres)
Briarbank	Satellite	31.28
Briarwood Hills	Satellite	5.0
Brookside Estates	Maintenance	215.0
Century Acres	Satellite	61.7
Clinton Township Sewer District 2	Maintenance	131.5
Clinton Township Sewer District 3	Maintenance	6.9
Forest Ridge	Satellite	9.2
Franklin County Landfill	Satellite	217.8
Franklin County Model Landfill	Satellite	171.1
Franklin Township Sewer District 1	Maintenance	225.85
Franklin Township Sewer District 4	Maintenance	680.20
Hamilton Meadows	Satellite	322.6
Holton Park	Satellite	16.6
Mifflin Township Sewer District 1	Maintenance	1029.88
Mon-e-bak	Satellite	278.21
New Rome	Satellite	1821.5
Oakhurst Knolls	Satellite	63.2
Ridgewood Estates	Satellite	194.7
San Margherita	Satellite	221.87
Taylor Estates	Satellite	45.9
Timberbrook	Satellite	178.23
Village Park	Satellite	85.80
Windrush Creek	Satellite	153.7
Windsong	Satellite	23.63
Worthington Hills	Satellite	596.8
Young Estates	Satellite	39.33
	Total	6827.32

**TABLE 4.1.8: CSO Regulators and Storm Tanks Activations for Columbus, OH
1/1/00-10/31/04.**

Location	Activations
Whittier Tanks	143
Alum Creek Tanks	54
Broad	29
Chestnut	45
Doe Alley	20
First	27
Frambes	29
Henry	38
Hudson	32
Indianola	35
King	24
Long	45
Markison	69
Moler	60
Peters Run	41
Rich	2
Spring	5
State	2
Third	39
Town	0
Whittier (regulator)	81

**TABLE 4.1.9: Average and Peak Overflow Volumes for CSO Activations,
Columbus OH, 1/1/00-10/31/04**

Location	Average Overflow Volume per Activation (MG)	Peak Overflow Volume per Activation (MG)	Total Overflow Volume for All Activations (MG)
Citywide (all flows)	56	894	9529
Whittier Tanks	57.8	731.5	8259
Alum Creek Tank	5.0	52.9	283
Broad	1.34	22	39
Chestnut	2.38	16	107
Doe Alley	0.73	10.13	15
First	0.41	5.34	11
Frambes	3.76	24.44	109
Henry	3.37	19.69	128
Hudson	0.57	6.74	18
Indianola	1.45	8.21	51
King	0.55	2.5	13
Long	0.54	5.58	25
Markison	0.65	2.75	45
Moler	1.08	5.77	65
Peters Run	3.93	19.11	161
Rich	0.06	0.08	0.1
Spring	0.14	0.26	0.7
State	0.08	0.12	0.2
Third	1.12	7.9	44
Town	0	0	0
Whittier (regulator)	2.15	7.99	174

TABLE 4.1.10: ES2005 Combined Sewer System Typical Year Performance

Regulator or Manhole Overflow	Annual Volume (MG)	Annual Duration (Hrs)	Annual # of Activations
Markison	10.7	24.3	18
Moler	10.1	41.3	20
Whittier	71.1	59.3	26
Peters Run	11.7	31.3	13
Rich	0	0	0
Town	0	0	0
State	0	0	0
Capital	0	0	0
Broad	0.82	4.25	3
Long	1.48	15.3	5
Spring	0.5	9.25	5
Chestnut	19.5	13.3	7
Cozzins	0	0	0
Henry	14.8	20	8
First	0.28	8	5
Third	9.08	19.8	5
King	1.26	9.5	6
Indianola	5.94	13	6
Frambes	2.63	10.8	3
Doe Alley	0.72	5	4
Hudson	0.18	1	1
Alum Creek	10.9	9	6
WSST	1060	356	25
Mound & Grant	3.13	58	30
Noble & Grant	0.32	8.75	7
Town & Fourth	5.51	38	24
Cherry & Fourth	5.03	41.5	23
Noble & Fourth	0	0	0
Mound e/o I-71	0.63	7	7
Kerr & Russell	2.09	28.8	20
Dodge Park	0.36	2	3
Subtotal	1250	N/A	N/A
JPWWTP Bypass	0	0	0
SWWTP Bypass	210	211	18
DSR 83	3.19	106	29

TABLE 4.2.1 SWWTP Outfall-002 Historical Data

Event End Date	Bypass Volume (MG)	Bypass Duration (hours)	Event End Date	Bypass Volume (MG)	Bypass Duration (hours)	Event End Date	Bypass Volume (MG)	Bypass Duration (hours)
1/9/98	72	11	4/5/00	81	34	3/27/02	49	28
2/19/98	56	27	4/9/00	172	33	4/15/02	77	34
4/10/98	17	27	4/19/00	0	9	6/1/02	2	8
4/17/98	132	38	5/29/00	61	23	6/7/02	77	42
4/19/98	0	11	9/24/00	0	19	7/24/02	5	7
5/3/98	18	15	10/6/00	47	25	11/11/02	5	8
6/15/98	3	7	12/12/00	0	3			
6/30/98	80	18	12/18/00	143	42	1/2/03	12	9
12/22/98	48	20				2/23/03	20	20
			1/15/01	1	1	8/5/03	16	14
1/13/99	9	13	4/12/01	44	37	8/30/03	1	2
1/19/99	94	34	4/20/01	12	9	9/1/03	99	21
1/21/99	1	3	5/17/01	22	27	9/3/03	133	31
2/8/99	16	13	5/20/01	160	44	9/27/03	87	19
3/3/99	4	9	5/23/01	30	29			
3/7/99	27	19	5/26/01	36	27	1/6/04	N/A	72
4/9/99	0	3	9/1/01	9	7	2/7/04	44	26
4/24/99	60	52	11/27/01	4	9	4/14/04	25	13
8/25/99	0	4	12/18/01	133	34	4/23/04	14	6
12/14/99	7	6				5/3/04	14	11
			5/2/02	7	10	5/22/04	65	21
1/4/00	51	22	5/15/02	93	53	6/11/04	36	11
2/15/00	87	34	5/29/02	11	9	8/1/04	29	19
2/19/00	30	17	2/1/02	2	10	10/19/04	11	6
3/21/00	37	21	3/17/02	1	2			

TABLE 4.2.2: Key System Components for the Operation of the Combined Sewer System

ID	Type	Description	2005 Existing System	2009 Foundation System
1	Weir	This is a relief weir to divert a portion of Clintonville Main Sanitary Trunk Sewer WWF to Franklin Main Interceptor Sewer.	Exists	Exists
2	Pump Station	This is the 2 nd Avenue P.S., which discharges the Franklin Main Interceptor Sewer (FMN) to the OSIS upstream of the existing blockage in Franklin Main Interceptor Sewer.	Exists	Exists
3	Weir	This is a relief weir to divert a portion of the combined area of the ACT basin to the OSIS basin at Chestnut Street Regulator.	Exists	Exists
4	Storm Tank	This is the Alum Creek Storm Tank, which is used to store combined flow from the ACT combined area. When the tank gets full, flow from the tank can overflow to the Alum Creek.	Exists	Exists
5	Sluice Gates	These gates inside the Alum Creek Storm Tank Control House activate the Alum Creek Storm Tank and regulate flow to the ACT from the ACT combined area.	Static opening at 0.65 feet x 4 feet	Same
35	Sluice Gate	This is the regulator gate inside the Whittier Street Control House (WSCH) to regulate combined flow from the OSIS basin to the Jackson Pike WWTP and to activate the WSST for storage.	Gate is open at 3 ft during DWF and throttled to 1 ft when Jackson Pike WWTP builds to 11 feet, gate closes when it is more than 12 feet.	Same
36	Sluice Gates	These are the emergency bypass gates in the WSCH. There are three gates that can be open if the water elevation in the OSIS upstream of the tanks cannot be maintained at 709 feet.	Gates 1, 2, and 3 will be open if water depth reaches 17.5 ft, 18 feet, and 18.5 feet, respectively.	Same
37	Sluice Gates	These are three sets of sluice gates to relieve flow from the OSIS to the WSST. Each set is 4 gates, each 4 feet x 4 feet.	Gates are closed during DWF and open when water elevation in the WSCH reaches 705 feet.	Same
38	Storm Tanks	These are the WSST, which are used to store combined flow from the OSIS combined basin. When the tanks get full, flow from the tanks can overflow to the Scioto River.	Exists	Exists

TABLE 4.2.3: Key System Components for the Operation of Separate Sanitary Sewer System

ID	Type	Description	2005 Existing System	2009 Foundation System
6	Sluice Gate	This is a window in a special gate in the Alum Creek Interceptor Sewer (ACIS) downstream of the Alum Creek Storm Tank Control House. This structure diverts DWF from ACIS to ACT. Portion of WWF can be diverted to Deshler Tunnel.	Exists	Exists
7	Weir	This is a partially blocked relief pipe that connects ACT to the ACIS. When ACT is surcharged, it relieves WWF to the ACIS.	Exists	Exists
8	Sluice Gate	This is a sluice gate inside the Flow Diversion Structure (FDS) to regulate flow from the Scioto Main Replacement to Jackson Pike WWTP.	Fully open	Same
9	Relief	This is a relief connection from Scioto Main Trunk Sewer (SCM) to West Side Sanitary Sewer (WSS).	Exists	Exists
10	Sluice Gate	This is a gate inside the Vortex Control Structure which regulates flow from Scioto Main Basin. The gate is throttled to allow for using the 9-foot SCM for storage and will be fully open when water depth in the Scioto Main Trunk Sewer is 17 ft or more at McKinley overflow structure.	36" of the pipe is open during DWF. If water depth rises to 17 feet at the McKinley structure, the gate will be fully opened to avoid overflow activation.	Same
11	Sluice Gates	These are two overflow windows from the OSIS to Renick Run Storm Sewer above the OSIS inside the OSIS Grit Chamber (at 701.1 feet).	removed 9/04	Removed
12	Sluice Gate	This is a sluice gate inside FDS to regulate flow from OSIS and SCM to Jackson Pike WWTP.	Fully Open	Same
14	Weir	This is a weir inside the Flow Control Structure (FCS) to divert Big Run Basin (BRN) dry weather flow to Jackson Pike WWTP. The weir fills the lower half of the Interconnector Sanitary Sewer (INT) and the weir opening is the upper half of the INT circular pipe.	Exists	Exists
15	Sluice Gate	This is a sluice gate inside the FCS to regulate flow from Jackson Pike WWTP into the Interconnecting Sanitary Trunk Sewer. The gate is used to maintain wet well depth in Jackson Pike WWTP less than 12 feet.	Gate is throttled to 1.5 feet during DWF and open to 2 feet during WWF event.	Same
16	Sluice Gates	These are two sluice gates inside the FDS to regulate flow from the FDS to the Interconnecting Sanitary Trunk Sewer.	Fully Open	Same
17	Relief Chamber	This is the Big Walnut Outfall Trunk Sewer (BWO)/Big Walnut Augmentation Rickenbacker (BWARI) Interceptor Interconnect Structure to relieve flow from BWO to BWARI. A weir and a set of gates could be utilized to regulate flow from BWO into BWARI.	Does not exist	Free relief from BWO to BWARI

TABLE 4.2.4: Key Components for the Operation of Headworks Facilities

ID	Type	Description	2005 Existing System	2009 Foundation System
13	Headwork	This is the Jackson Pike WWTP. Jackson Pike WWTP has a maximum capacity of 102 MGD during WWF events. The physical bypass elevation is at 694.5 feet. Wet well elevation is to be maintained less than 688.00 feet.	Operate at 70- 80 MGD and increase to 102 MGD during WWF.	Same
18	Weir	This is a bypass weir (002-bypass) at Southerly WWTP. The bypass weir elevation is 681 feet.	Exists	Exists
19	Sluice Gate	This is a sluice gate inside the influent junction chamber to regulate flow from the INT to Southerly WWTP. The gate is 8 feet x 8 feet.	N/A	Fully Open
20	Headwork	This is the Southerly WWTP. Southerly WWTP has a maximum capacity that is upgraded following the general engineering planning horizon.	Peak capacity is 225 MGD	Peak capacity is 260 MGD.
39	Sluice Gates	These are two sluice gates (10 feet x 8 feet) inside the Southerly Influent Junction Chamber (IJC) to regulate flow from the IJC to Southerly WWTP. Gates will be throttled during WWF events to maintain wet well elevation less than 675 feet.	N/A	Two gates are fully open during DWF. During WWF, maintain wet well at 675 feet by closing one gate and throttling the other gate per the LTCP-DDM.

TABLE 4.3.1 Dry Weather and Wet Weather Water Quality Sampling Day(s) and Event Type	
Sampling Day(s)	Sampling Event Type
October 14-17, 2003	Wet Weather
October 25, 2003	Dry Weather
April 30 - May 3, 2004	Wet Weather
July 1, 2004	Dry Weather
July 11 - 14, 2004	Wet Weather
July 30 – August 2, 2004	Wet Weather
August 8, 2004	Dry Weather
August 17, 2004	Dry Weather
September 7, 2004	Dry Weather
September 8 - 11, 2004	Wet Weather
October 18 - 21, 2004	Wet Weather

TABLE 4.3.2: K Factors for Soils Adjacent To and Near Receiving Waters

Soil Association	K factor
Crosby	0.43
Bennington	0.43
Alexandria	0.37
Cardington	0.37
Celina	0.37
Eldean	0.37
Genesee	0.37
Miamian	0.37
Ockley	0.37
Sloan	0.37
Kokomo	0.32
Medway	0.32
Warsaw	0.28
Pewamo	0.24

TABLE 4.3.3:
Upper Olentangy Surface Waters Area - Wilson Bridge Road Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.430	8.850	8.008
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.186	0.906	0.554
Dissolved Oxygen (mg/l)	5.0 min. 6.0 average	5.640	15.980	8.716
Temperature (°C)	29.4 max.	8.230	28.950	20.101
Total Chlorophyll (mg/l)	NA	0.000	29.800	6.143
Turbidity (NTU)	NA	0.000	902.900	27.346
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	3.550	8.790	7.996
Specific Conductivity (µS/cm)	2400 @ 25°C	8.000	825.000	556.522
Dissolved Oxygen (mg/l)	5.0 min 6.0 average	5.790	18.650	8.612
Temperature (°C)	29.4 max.	8.280	28.390	19.823
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	3.000	11.000	5.181
CBOD - 5 Day (mg/l)	NA	2.000	4.500	2.117
Total Chlorophyll (mg/l)	NA	1.330	5.710	3.340
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	2.700	7.100	4.997
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	3.800	12.200	5.862
Copper- Dissolved (µg/l)	26 max. 16 average	1.840	6.320	4.929
Lead – Total (µg/l)	300 max. 16 average	0.440	8.350	5.031
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.810	0.263
Nickel – Total (µg/l)	840 max. 94 average	4.600	11.900	5.875

TABLE 4.3.3: (continued)
Upper Olentangy Surface Waters Area - Wilson Bridge Road Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	8.290	5.201
Zinc – Total (µg/l)	220 max. 220 average	7.650	81.300	21.623
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	106.000	14.381
Phosphorus - Total (mg/l)	NA	0.050	4.800	0.298
Phosphorus –Dissolved (mg/l)	NA	0.050	0.880	0.078
Total Suspended Solids (mg/l)	NA	BDL	200.000	31.358
Total Dissolved Solids (mg/l)	1500	250.000	470.000	347.612
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.000	0.412
Nitrate Nitrite (mg/l)	NA	0.560	3.300	1.327
Ammonia Nitrogen (mg/l)	0.9 max.	0.050	1.100	0.060
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	<0.50		
Chromium – Total (mg/kg-dry)		10.2		
Copper – Total (mg/kg-dry)		21.0		
Lead – Total (mg/kg-dry)		20.6		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		23.8		
Zinc – Total (mg/kg-dry)		72		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	77.0		
Total Number of Species	NA	35		
Total Number of Hybrid Species	NA	2		
IBI	50	52		
1 st Pass		46		
2 nd Pass	9.5	10.5		
MIwb		9.9		
1 st Pass	48	48		
2 nd Pass				
ICI				

TABLE 4.3.3: (continued)			
Upper Olentangy Surface Waters Area - Wilson Bridge Road Zone			
Metering and Sampling Data Summary			
Biology – Freshwater Mussels			
Species		Number Living/Number Fresh Dead	
Total Mussels		51/11	
Total Species of Mussels		7/5	
<i>Species of Concern</i>			
<i>Alasmidonta marginata</i> - Elktoe		3/0	
<i>Lampsilis fasciola</i> - Wavy-rayed Lampmussel		0/1	
<i>Ptychobranthus fasciolaris</i> - Kidneyshell		2/1	
<i>Threatened Species</i>			
No threatened species observed		NA	
<i>Endangered Species</i>			
No endangered species observed		NA	
Bacteria			
Measure	WQS ¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>	1000	40	250
<i>Wet Weather</i>		1	120,000
E. coli			
<i>Dry Weather</i>	126	20	230
<i>Wet Weather</i>		1	43,000

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.4:
Upper Olentangy Surface Waters Area – State Route 161 Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.390	8.600	7.995
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.167	0.856	0.566
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	5.500	12.820	8.182
Temperature (°C)	29.4 max.	8.670	28.130	20.689
Total Chlorophyll (mg/l)	NA	0.000	75.400	8.826
Turbidity (NTU)	NA	1.400	847.400	37.966
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.390	8.640	7.990
Specific Conductivity (µS/cm)	2400 @ 25°C	52.000	843.000	564.244
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	5.750	14.790	8.243
Temperature (°C)	29.4 max.	8.600	27.490	19.332
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.300	12.000	5.197
CBOD - 5 Day (mg/l)	NA	2.000	5.000	2.109
Total Chlorophyll (mg/l)	NA	2.560	7.130	4.250
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	4.857
Chromium – Total (µg/l)	3200 max. 150 average	2.200	7.480	4.995
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	4.857
Copper – Total (µg/l)	27 max. 17 average	3.300	15.000	6.213
Copper- Dissolved (µg/l)	26 max. 16 average	1.930	1.930	1.930
Lead – Total (µg/l)	300 max. 16 average	0.770	6.180	4.979
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	4.857
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	11.000	0.420
Nickel – Total (µg/l)	840 max. 94 average	4.500	11.300	5.688

TABLE 4.3.4: (continued)
Upper Olentangy Surface Waters Area – State Route 161 Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	6.740	5.118
Zinc – Total (µg/l)	220 max. 220 average	6.000	54.100	20.851
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	55.100	11.781
Phosphorus - Total (mg/l)	NA	0.050	0.980	0.137
Phosphorus –Dissolved (mg/l)	NA	0.050	0.110	0.063
Total Suspended Solids (mg/l)	NA	4.000	160.000	30.676
Total Dissolved Solids (mg/l)	1500	230.000	440.000	332.647
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.200	0.387
Nitrate Nitrite (mg/l)	NA	0.390	3.300	1.310
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	1.300	0.060
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	<0.50		
Chromium – Total (mg/kg-dry)		11.6		
Copper – Total (mg/kg-dry)		21.0		
Lead – Total (mg/kg-dry)		21.0		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		18.4		
Zinc – Total (mg/kg-dry)		74		
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	50	450	
Dry Weather		70	110,000	
Wet Weather	126			
E. coli				
Dry Weather		1	280	
Wet Weather		30	22,000	

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.5:
Upper Olentangy Surface Waters Area - Henderson Road Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.520	8.700	7.981
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.215	0.867	0.532
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	3.92	12.900	7.892
Temperature (°C)	29.4 max.	8.680	28.850	20.535
Total Chlorophyll (mg/l)	NA	0.000	195.100	8.164
Turbidity (NTU)	NA	0.000	1,760.300	40.149
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.540	8.540	7.994
Specific Conductivity (µS/cm)	2400 @ 25°C	296.000	842.000	561.562
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	5.730	13.730	8.387
Temperature (°C)	29.4 max.	8.840	27.700	19.640
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.300	11.000	5.364
CBOD - 5 Day (mg/l)	NA	2.000	5.000	2.134
Total Chlorophyll (mg/l)	NA	1.840	11.820	8.030
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	6.190	5.017
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	11.800	5.895
Copper- Dissolved (µg/l)	26 max. 16 average	1.960	1.960	1.960
Lead – Total (µg/l)	300 max. 16 average	BDL	10.900	5.166
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	1.500	0.276
Nickel – Total (µg/l)	840 max. 94 average	BDL	10.400	5.683
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	6.060	5.070

TABLE 4.3.5: (continued)				
Upper Olentangy Surface Waters Area - Henderson Road Zone				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	8.280	72.100	23.733
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	22.600	11.273
Phosphorus - Total (mg/l)	NA	0.050	14.000	0.420
Phosphorus –Dissolved (mg/l)	NA	0.050	0.110	0.060
Total Suspended Solids (mg/l)	NA	4.000	140.000	35.507
Total Dissolved Solids (mg/l)	1500	170.000	430.000	323.913
Total Kjeldahl Nitrogen (mg/l)	NA	0.000	1.200	0.380
Nitrate Nitrite (mg/l)	NA	0.430	3.300	1.187
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.490	0.066
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	<0.50		
Chromium – Total (mg/kg-dry)		11.5		
Copper – Total (mg/kg-dry)		23.2		
Lead – Total (mg/kg-dry)		23.5		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		21.6		
Zinc – Total (mg/kg-dry)		87		
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	160	700	
Dry Weather		190	111,000	
Wet Weather				
E. coli	126	80	430	
Dry Weather		1	64,000	
Wet Weather				

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.6:
Lower Olentangy Surface Waters Area - Dodridge Street Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.220	8.650	7.861
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.210	0.869	0.520
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	6.360	15.330	8.825
Temperature (°C)	29.4 max.	8.900	28.540	20.382
Total Chlorophyll (mg/l)	NA	0.100	125.500	8.946
Turbidity (NTU)	NA	0.000	1,792.600	42.214
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.640	8.610	7.951
Specific Conductivity (µS/cm)	2400 @ 25°C	247.000	841.000	549.567
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	6.390	11.580	8.355
Temperature (°C)	29.4 max.	9.020	27.370	19.968
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.100	14.000	5.739
CBOD - 5 Day (mg/l)	NA	2.000	6.000	2.178
Total Chlorophyll (mg/l)	NA	3.370	12.630	8.933
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	4.840
Chromium – Total (µg/l)	3200 max. 150 average	BDL	6.780	5.029
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	252.000	14.720
Copper – Total (µg/l)	27 max. 17 average	BDL	20.700	6.245
Copper- Dissolved (µg/l)	26 max. 16 average	2.040	12.700	5.190
Lead – Total (µg/l)	300 max. 16 average	BDL	23.800	5.729
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	4.840
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.500	0.255
Nickel – Total (µg/l)	840 max. 94 average	BDL	10.700	5.506

TABLE 4.3.6: (continued)
Lower Olentangy Surface Waters Area - Dodridge Street Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	238.000	14.400
Zinc – Total (µg/l)	220 max. 220 average	9.590	440.000	37.647
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	23.600	12.542
Phosphorus - Total (mg/l)	NA	0.050	53.000	0.952
Phosphorus –Dissolved (mg/l)	NA	0.050	0.090	0.056
Total Suspended Solids (mg/l)	NA	6.000	150.000	32.000
Total Dissolved Solids (mg/l)	1500	150.000	460.000	312.576
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.700	0.412
Nitrate Nitrite (mg/l)	NA	0.370	3.300	1.091
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.140	0.056
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.81		
Chromium – Total (mg/kg-dry)		21.3		
Copper – Total (mg/kg-dry)		42.5		
Lead – Total (mg/kg-dry)		86.5		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		28.4		
Zinc – Total (mg/kg-dry)		160		
Biology – Freshwater Mussels				
Species		Number Living/Number Fresh Dead		
Total Mussels		18/6		
Total Species of Mussels		5/4		
Species of Concern				
Alasmidonta marginata - Elktoe		2/0		
Threatened Species				
No threatened species observed		NA		
Endangered Species				
No endangered species observed		NA		

TABLE 4.3.6: (continued) Lower Olentangy Surface Waters Area - Dodridge Street Zone Metering and Sampling Data Summary			
Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		160	300
<i>Wet Weather</i>	1000	100	71,000
E. coli			
<i>Dry Weather</i>		60	220
<i>Wet Weather</i>	126	150	48,000
Acute Toxicity			
Measure	WQS	24 Hour Value	
Acute Toxicity			
<i>Dry Weather</i>		0 mortality, 5% affected	
<i>Wet Weather</i>		0 mortality, 0% affected	

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.7:
Lower Olentangy Surface Waters Area – John Herrick Drive Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.380	9.000	7.872
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.190	0.924	0.552
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	4.780	19.340	9.024
Temperature (°C)	29.4 max.	9.320	28.930	20.418
Total Chlorophyll (mg/l)	NA	0.000	152.900	11.365
Turbidity (NTU)	NA	3.700	1,600.500	91.255
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	5.200	8.610	7.882
Specific Conductivity (µS/cm)	2.4 @ 25°C	6.050	6,647.000	556.095
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	6.180	12.690	8.012
Temperature (°C)	29.4 max.	9.400	28.100	19.721
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.600	14.000	6.199
CBOD - 5 Day (mg/l)	NA	2.000	5.000	2.362
Total Chlorophyll (mg/l)	NA	27.510	48.100	35.070
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	5.940	5.025
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	38.800	6.577
Copper- Dissolved (µg/l)	26 max. 16 average	2.330	6.180	4.986
Lead – Total (µg/l)	300 max. 16 average	BDL	8.400	5.244
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.520	0.261
Nickel – Total (µg/l)	840 max. 94 average	BDL	9.990	5.393

TABLE 4.3.7: (continued)
Lower Olentangy Surface Waters Area – John Herrick Drive Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	5.110	5.004
Zinc – Total (µg/l)	220 max. 220 average	10.400	90.000	34.980
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	36.500	13.780
Phosphorus - Total (mg/l)	NA	0.050	4.800	0.216
Phosphorus –Dissolved (mg/l)	NA	0.050	0.080	0.054
Total Suspended Solids (mg/l)	NA	5.000	130.000	30.775
Total Dissolved Solids (mg/l)	1500	140.000	430.000	311.549
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.500	0.406
Nitrate Nitrite (mg/l)	NA	0.350	3.300	1.038
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.140	0.059
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.80		
Chromium – Total (mg/kg-dry)		18.2		
Copper – Total (mg/kg-dry)		40.2		
Lead – Total (mg/kg-dry)		39.8		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		24.4		
Zinc – Total (mg/kg-dry)		122		
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	190	750	
Dry Weather		370	89,000	
Wet Weather	126	50	310	
E. coli		210	85,000	
Dry Weather				
Wet Weather				

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.8:
Lower Olentangy Surface Waters Area – Fifth Avenue Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	6.070	8.760	7.952
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.000	0.918	0.561
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	6.300	19.460	8.893
Temperature (°C)	29.4 max.	5.940	29.310	20.385
Total Chlorophyll (mg/l)	NA	0.000	330.700	13.654
Turbidity (NTU)	NA	0.200	1,519.800	104.836
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.390	8.910	7.920
Specific Conductivity (µS/cm)	2.4 @ 25°C	259.000	904.000	548.887
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	6.370	12.130	8.665
Temperature (°C)	29.4 max.	9.470	28.210	20.050
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.600	10.000	5.971
CBOD - 5 Day (mg/l)	NA	2.000	7.500	2.414
Total Chlorophyll (mg/l)	NA	26.490	50.100	38.295
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	4.742
Chromium – Total (µg/l)	3200 max. 150 average	BDL	7.590	5.032
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	4.742
Copper – Total (µg/l)	27 max. 17 average	BDL	20.300	7.257
Copper- Dissolved (µg/l)	26 max. 16 average	3.940	6.990	5.093
Lead – Total (µg/l)	300 max. 16 average	BDL	15.000	5.258
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	4.742
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.500	0.263
Nickel – Total (µg/l)	840 max. 94 average	BDL	10.000	5.400

TABLE 4.3.8: (continued)
Lower Olentangy Surface Waters Area – Fifth Avenue Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	5.270	5.026
Zinc – Total (µg/l)	220 max. 220 average	9.740	80.000	22.780
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	89.600	12.062
Phosphorus - Total (mg/l)	NA	0.050	1.600	0.141
Phosphorus –Dissolved (mg/l)	NA	0.005	0.080	0.053
Total Suspended Solids (mg/l)	NA	5.000	160.000	33.686
Total Dissolved Solids (mg/l)	1500	100.000	440.000	297.209
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	0.910	0.378
Nitrate Nitrite (mg/l)	NA	0.200	3.200	0.977
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.190	0.061
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	1.04		
Chromium – Total (mg/kg-dry)		16.8		
Copper – Total (mg/kg-dry)		29.6		
Lead – Total (mg/kg-dry)		37.2		
Mercury – Total (mg/kg-dry)		0.33		
Nickel – Total (mg/kg-dry)		16.4		
Zinc – Total (mg/kg-dry)		1.72		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	34.5		
Total Number of Species	NA	17		
Total Number of Hybrid Species	NA	2		
IBI	30			
1 st Pass		34		
2 nd Pass		34		
MIwb	6.9			
1 st Pass		6.8		
2 nd Pass		6.8		
Invertebrate Community Index (ICI)	NA	NA		

TABLE 4.3.8: (continued)			
Lower Olentangy Surface Waters Area – Fifth Avenue Zone			
Metering and Sampling Data Summary			
Biology – Freshwater Mussels			
Species		Number Living/Number Fresh Dead	
Total Mussels		52/29	
Total Species of Mussels		9/10	
<i>Species of Concern</i>			
<i>Alasmidonta marginata</i> - Elktoe		4/1	
<i>Ptychobranchus fasciolaris</i> - Kidneyshell		0/1	
<i>Threatened Species</i>			
No threatened species observed		NA	
<i>Endangered Species</i>			
No endangered species observed		NA	
Bacteria			
Measure	WQS ¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>	1000	150	470
<i>Wet Weather</i>		210	130,000
E. coli			
<i>Dry Weather</i>	126	120	550
<i>Wet Weather</i>		60	62,000

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.9:
Lower Olentangy Surface Waters Area – Goodale Avenue Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.330	8.720	7.857
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.228	0.922	0.533
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	5.350	18.180	8.498
Temperature (°C)	29.4 max.	9.550	29.260	21.076
Total Chlorophyll (mg/l)	NA	0.000	113.000	12.668
Turbidity (NTU)	NA	0.000	1,736.400	59.998
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.070	8.420	7.888
Specific Conductivity (µS/cm)	2.4 @ 25°C	247.000	788.000	524.385
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	6.260	13.480	8.458
Temperature (°C)	29.4 max.	9.600	28.360	20.512
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.800	11.000	6.026
CBOD - 5 Day (mg/l)	NA	2.000	4.600	2.354
Total Chlorophyll (mg/l)	NA	18.800	26.490	22.597
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	5.510	5.011
Chromium – Dissolved (µg/l)	1000 max. 130 average	1.510	26.700	5.700
Copper – Total (µg/l)	27 max. 17 average	BDL	33.100	8.278
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	15.100	5.497
Lead – Total (µg/l)	300 max. 16 average	BDL	26.700	5.967
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.050	1.100	0.276
Nickel – Total (µg/l)	840 max. 94 average	BDL	10.900	5.438
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	5.800	5.054

TABLE 4.3.9: (continued)				
Lower Olentangy Surface Waters Area – Goodale Avenue Zone				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	9.350	80.700	26.776
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	18.600	10.150
Phosphorus - Total (mg/l)	NA	0.050	1.600	0.175
Phosphorus –Dissolved (mg/l)	NA	0.050	0.090	0.054
Total Suspended Solids (mg/l)	NA	7.000	160.000	35.030
Total Dissolved Solids (mg/l)	1500 max.	160.000	470.000	300.000
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.400	0.441
Nitrate Nitrite (mg/l)	NA	0.050	3.200	0.950
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.280	0.068
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.59		
Chromium – Total (mg/kg-dry)		24.2		
Copper – Total (mg/kg-dry)		30.5		
Lead – Total (mg/kg-dry)		70.0		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		19.1		
Zinc – Total (mg/kg-dry)		111		
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	190	990	
Dry Weather		210	75,000	
Wet Weather				
E. coli	126	80	540	
Dry Weather		140	45,000	
Wet Weather				

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.10:
Scioto-Downtown Surface Waters Area – State Route 33 Zone (Olentangy River)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.530	8.720	7.902
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.203	0.923	0.555
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	2.710	18.050	8.438
Temperature (°C)	29.4 max.	9.550	28.830	20.525
Total Chlorophyll (mg/l)	NA	0.300	113.500	9.786
Turbidity (NTU)	NA	2.100	1,522.800	44.998
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.570	8.420	7.888
Specific Conductivity (µS/cm)	2.4 @ 25°C	274.000	855.000	548.414
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	5.950	12.370	8.364
Temperature (°C)	29.4 max.	9.670	28.410	19.524
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.700	11.000	6.022
CBOD - 5 Day (mg/l)	NA	2.000	5.000	2.331
Total Chlorophyll (mg/l)	NA	19.400	23.500	22.113
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	3.500	5.230	4.982
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	3.700	51.800	7.896
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	8.710	5.186
Lead – Total (µg/l)	300 max. 16 average	1.600	15.200	5.469
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.500	0.257
Nickel – Total (µg/l)	840 max. 94 average	4.400	14.400	5.613
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	5.120	5.007

TABLE 4.3.10: (continued)
Scioto-Downtown Surface Waters Area – State Route 33 Zone (Olentangy River)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	11.200	59.700	25.586
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	18.700	9.409
Phosphorus - Total (mg/l)	NA	0.050	0.590	0.101
Phosphorus –Dissolved (mg/l)	NA	0.050	0.230	0.057
Total Suspended Solids (mg/l)	NA	7.000	190.000	34.942
Total Dissolved Solids (mg/l)	1500 max.	140.000	750.000	309.710
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.900	0.448
Nitrate Nitrite (mg/l)	NA	0.370	3.200	0.987
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.400	0.069
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	<0.50		
Chromium – Total (mg/kg-dry)		16.0		
Copper – Total (mg/kg-dry)		18.6		
Lead – Total (mg/kg-dry)		18.8		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		18.4		
Zinc – Total (mg/kg-dry)		<1.0		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	48.5		
Total Number of Species	NA	29		
Total Number of Hybrid Species	NA	2		
IBI	30			
1 st Pass		32		
2 nd Pass		32		
MIwb	6.9			
1 st Pass		7.8		
2 nd Pass		9.1		
ICI	NA	28		

TABLE 4.3.10: (continued)
Scioto-Downtown Surface Waters Area – State Route 33 Zone (Olentangy River)
Metering and Sampling Data Summary

Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		160	1100
<i>Wet Weather</i>	1000	210	120,000
E. coli			
<i>Dry Weather</i>		160	810
<i>Wet Weather</i>	126	140	45,000

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.11:
Scioto-Downtown Surface Waters Area – Souder Avenue Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.490	8.870	7.961
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.240	0.860	0.567
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	3.330	15.260	8.445
Temperature (°C)	30.6 max.	10.330	27.340	20.387
Total Chlorophyll (mg/l)	NA	0.000	75.200	13.756
Turbidity (NTU)	NA	0.000	695.900	38.729
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.550	8.760	8.084
Specific Conductivity (µS/cm)	2400 @ 25°C	8.030	713.000	576.155
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	6.080	15.150	9.093
Temperature (°C)	30.6 max.	10.320	27.760	20.683
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.200	11.000	5.718
CBOD - 5 Day (mg/l)	NA	2.000	4.800	2.293
Total Chlorophyll (mg/l)	NA	15.790	33.700	26.363
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	BDL	BDL
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	14.200	6.043
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	8.020	5.199
Lead – Total (µg/l)	300 max. 16 average	BDL	5.240	5.004
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.790	0.266
Nickel – Total (µg/l)	840 max. 94 average	BDL	7.580	5.171
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	5.540	5.046

TABLE 4.3.11: (continued)
Scioto-Downtown Surface Waters Area – Souder Avenue Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	7.920	43.000	18.412
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	53.500	11.644
Phosphorus - Total (mg/l)	NA	0.050	2.200	0.127
Phosphorus –Dissolved (mg/l)	NA	0.050	0.100	0.053
Total Suspended Solids (mg/l)	NA	4.000	57.000	20.971
Total Dissolved Solids (mg/l)	1500 max.	230.000	420.000	340.294
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.100	0.429
Nitrate Nitrite (mg/l)	NA	0.050	4.400	1.268
Ammonia Nitrogen (mg/l)	1.6 max.	0.050	0.210	0.063
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.68		
Chromium – Total (mg/kg-dry)		1.06		
Copper – Total (mg/kg-dry)		31.9		
Lead – Total (mg/kg-dry)		64.0		
Mercury – Total (mg/kg-dry)		0.33		
Nickel – Total (mg/kg-dry)		18.0		
Zinc – Total (mg/kg-dry)		114		
Biology – Freshwater Mussels				
Species		Number Living/Number Fresh Dead		
Total Mussels		39/22		
Total Species of Mussels		4/4		
Species of Concern				
No Species of Concern Observed		NA		
Threatened Species				
No Threatened Species Observed		NA		
Endangered Species				
No Endangered Species Observed		NA		
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	30	100	
Dry Weather		1	54,000	
Wet Weather	126	10	50	
E. coli		1	49,000	
Dry Weather				
Wet Weather				

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.12:
Scioto-Downtown Surface Waters Area – Broad Street Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data</i>				
pH	6.5 – 9.0	7.340	8.580	7.913
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.139	0.880	0.538
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	1.040	17.340	8.201
Temperature (°C)	30.6 max.	10.310	28.240	21.114
Total Chlorophyll (mg/l)	NA	0.300	84.700	13.403
Turbidity (NTU)	NA	0.300	1178.500	35.392
<i>Sampling Data – Field Measured</i>				
pH	6.5 – 9.0	7.440	12.380	8.072914
Specific Conductivity (µS/cm)	2.4 @ 25°C	316.000	806.000	536.9835
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	5.660	155.000	9.889099
Temperature (°C)	30.6 max.	10.370	27.890	20.18078
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.000	16.000	6.433
CBOD - 5 Day (mg/l)	NA	2.000	8.400	2.589
Total Chlorophyll (mg/l)	NA	17.320	50.100	33.133
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	4.842
Chromium – Total (µg/l)	3200 max. 150 average	BDL	BDL	BDL
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	4.842
Copper – Total (µg/l)	27 max. 17 average	BDL	32.700	8.212
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	14.300	5.631
Lead – Total (µg/l)	300 max. 16 average	BDL	7.390	5.043
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	4.842
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	1.800	0.269
Nickel – Total (µg/l)	840 max. 94 average	BDL	9.880	5.168
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	BDL	BDL

TABLE 4.3.12: (continued)
Scioto-Downtown Surface Waters Area – Broad Street Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	6.000	47.800	19.562
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	19.200	9.082
Phosphorus - Total (mg/l)	NA	0.050	3.900	0.156
Phosphorus –Dissolved (mg/l)	NA	0.050	0.090	0.051
Total Suspended Solids (mg/l)	NA	4.000	68.000	21.452
Total Dissolved Solids (mg/l)	1500 max.	180.000	470.000	320.000
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.900	0.409
Nitrate Nitrite (mg/l)	NA	0.050	3.800	1.002
Ammonia Nitrogen (mg/l)	1.6 max.	0.050	0.900	0.065
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	1.06		
Chromium – Total (mg/kg-dry)		15.2		
Copper – Total (mg/kg-dry)		49.0		
Lead – Total (mg/kg-dry)		88.5		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		16.2		
Zinc – Total (mg/kg-dry)		124		
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	20	270	
Dry Weather		40	81,000	
Wet Weather	126	20	130	
E. coli		1	39,000	
Dry Weather				
Wet Weather				

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.13:
Scioto-Downtown Surface Waters Area – Town Street Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.440	8.680	7.926
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.257	0.879	0.544
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	2.030	20.670	8.768
Temperature (°C)	30.6 max.	10.330	27.250	20.634
Total Chlorophyll (mg/l)	NA	0.000	129.4	18.226
Turbidity (NTU)	NA	0.000	68.700	14.213
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.630	12.300	10.004
Specific Conductivity (µS/cm)	2400 @ 25°C	257.000	808.000	540.037
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	6.450	94.000	9.384
Temperature (°C)	30.6 max.	10.220	28.580	19.835
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.800	14.000	6.275
CBOD - 5 Day (mg/l)	NA	2.000	9.300	2.560
Total Chlorophyll (mg/l)	NA	8.560	61.100	35.208
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	11.300	5.059
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	9.330	5.056
Copper – Total (µg/l)	27 max. 17 average	BDL	10.400	5.472
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	27.400	5.291
Lead – Total (µg/l)	300 max. 16 average	BDL	6.460	5.018
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.600	0.262
Nickel – Total (µg/l)	840 max. 94 average	BDL	8.380	5.149
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	5.530	5.017

TABLE 4.3.13: (continued)				
Scioto-Downtown Surface Waters Area – Town Street Zone				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	8.400	35.500	18.535
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	20.900	9.341
Phosphorus - Total (mg/l)	NA	0.050	280.000	1.650
Phosphorus –Dissolved (mg/l)	NA	0.050	0.180	0.052
Total Suspended Solids (mg/l)	NA	4.000	120.000	22.015
Total Dissolved Solids (mg/l)	1500 max.	1.000	720.000	322.673
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	2.300	0.429
Nitrate Nitrite (mg/l)	NA	0.050	3.400	0.989
Ammonia Nitrogen (mg/l)	1.6 max.	0.050	0.260	0.090
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	1.02		
Chromium – Total (mg/kg-dry)		24.7		
Copper – Total (mg/kg-dry)		62.5		
Lead – Total (mg/kg-dry)		87.5		
Mercury – Total (mg/kg-dry)		0.12		
Nickel – Total (mg/kg-dry)		16.6		
Zinc – Total (mg/kg-dry)		153		
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	30	200	
Dry Weather		80	>200,000	
Wet Weather	126	1	90	
E. coli		10	82,000	
Dry Weather	126	1	90	
Wet Weather		10	82,000	

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.14:
Scioto-Downtown Surface Waters Area – Main Street Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.020	8.939	7.930
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.004	0.878	0.540
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	4.180	17.600	8.785
Temperature (°C)	30.6 max.	10.300	27.310	20.674
Total Chlorophyll (mg/l)	NA	0.100	86.400	15.213
Turbidity (NTU)	NA	0.900	1,547.000	49.026
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.580	13.720	8.128
Specific Conductivity (µS/cm)	2400 @ 25°C	380.000	790.000	548.591
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	6.140	16.250	9.318
Temperature (°C)	30.6 max.	8.31	28.340	20.325
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.800	17.000	6.498
CBOD - 5 Day (mg/l)	NA	2.000	11.000	2.740
Total Chlorophyll (mg/l)	NA			
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	5.530	5.003
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	26.300	5.830
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	6.420	5.021
Lead – Total (µg/l)	300 max. 16 average	BDL	8.220	5.028
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.500	0.258
Nickel – Total (µg/l)	840 max. 94 average	BDL	8.550	5.141
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	5.980	5.026

TABLE 4.3.14: (continued)
Scioto-Downtown Surface Waters Area – Main Street Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	8.310	50.100	18.465
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	62.000	10.532
Phosphorus - Total (mg/l)	NA	0.050	9.400	0.243
Phosphorus –Dissolved (mg/l)	NA	0.050	0.080	0.051
Total Suspended Solids (mg/l)	NA	4.000	89.000	21.629
Total Dissolved Solids (mg/l)	1500 max.	200.000	480.000	321.831
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.500	0.401
Nitrate Nitrite (mg/l)	NA	0.050	3.400	0.962
Ammonia Nitrogen (mg/l)	1.6 max.	0.050	1.700	0.074
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.60		
Chromium – Total (mg/kg-dry)		26.6		
Copper – Total (mg/kg-dry)		52.5		
Lead – Total (mg/kg-dry)		182.0		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		17.4		
Zinc – Total (mg/kg-dry)		307		
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	10	590	
<i>Dry Weather</i>		90	90,000	
<i>Wet Weather</i>	126	1	260	
E. coli		10	46,000	
<i>Dry Weather</i>				
<i>Wet Weather</i>				
Toxicity				
Measure	WQS	24 Hour Value		
Acute Toxicity				
<i>Dry Weather</i>		0 mortality, 0% affected		
<i>Wet Weather</i>		0 mortality, 0% affected		

¹ 30-day geometric mean values in the current Ohio WQS

**TABLE 4.3.15:
Scioto-Downtown Surface Waters Area – Interstate 70 Zone
Metering and Sampling Data Summary**

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data</i>				
pH	6.5 – 9.0	7.620	8.720	8.043
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.246	0.863	0.537
Dissolved Oxygen (mg/l)	3.0 min.	3.990	13.790	8.914
	4.0 average			
Temperature (°C)	30.6 max.	10.520	27.110	21.184
Total Chlorophyll (mg/l)	NA	0.300	97.4	16.853
Turbidity (NTU)	NA	0.0400	1155.500	52.381
<i>Sampling Data – Field Measured</i>				
pH	6.5 – 9.0	7.770	8.580	8.096
Specific Conductivity (µS/cm)	2400 @ 25°C	447.000	671.000	542.071
Dissolved Oxygen (mg/l)	4.0 min	7.470	13.400	9.657
	5.0 average			
Temperature (°C)	30.6 max.	15.050	25.540	21.075
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	72.0		
Total Number of Species	NA	21		
Total Number of Hybrid Species	NA	3		
IBI	30			
1 st Pass		38		
2 nd Pass		34		
MIwb				
1 st Pass	6.9	8.0		
2 nd Pass		8.1		
ICI	NA	NA		

TABLE 4.3.16:
Scioto-Downtown Surface Waters Area – Greenlawn Avenue Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.520	8.940	8.063
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.253	0.848	0.508
Dissolved Oxygen (mg/l)	3.0 min. 4.0 average	6.400	15.310	8.958
Temperature (°C)	30.6 max.	10.750	29.490	21.097
Total Chlorophyll (mg/l)	NA	1.800	118.000	15.897
Turbidity (NTU)	NA	4.300	1,108.400	50.403
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.660	8.750	8.076
Specific Conductivity (µS/cm)	2400 @ 25°C	378.000	762.000	550.389
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	7.050	11.310	8.710
Temperature (°C)	30.6 max.	10.920	28.290	20.333
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.600	49.000	7.758
CBOD - 5 Day (mg/l)	NA	2.000	8.300	3.087
Total Chlorophyll (mg/l)	NA	24.400	34.800	28.223
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	5.730	5.018
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	7.330	5.078
Copper – Total (µg/l)	27 max. 17 average	BDL	23.400	6.165
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	5.560	5.019
Lead – Total (µg/l)	300 max. 16 average	BDL	22.300	5.513
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.500	0.266
Nickel – Total (µg/l)	840 max. 94 average	BDL	9.060	5.229
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	7.790	5.102

TABLE 4.3.16: (continued)				
Scioto-Downtown Surface Waters Area – Greenlawn Avenue Zone				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	8.630	111.000	24.997
Zinc – Dissolved (µg/l)	210 max. 210 average	BDL	26.200	10.984
Phosphorus - Total (mg/l)	NA	0.050	5.300	0.291
Phosphorus –Dissolved (mg/l)	NA	0.050	1.300	0.075
Total Suspended Solids (mg/l)	NA	7.000	110.000	24.836
Total Dissolved Solids (mg/l)	1500 max.	210.000	560.000	335.479
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	5.700	0.611
Nitrate Nitrite (mg/l)	NA	0.050	7.300	1.084
Ammonia Nitrogen (mg/l)	1.6 max.	0.050	2.600	0.150
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.79		
Chromium – Total (mg/kg-dry)		19.4		
Copper – Total (mg/kg-dry)		34.1		
Lead – Total (mg/kg-dry)		49.8		
Mercury – Total (mg/kg-dry)		0.33		
Nickel – Total (mg/kg-dry)		15.1		
Zinc – Total (mg/kg-dry)		86		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	72.0		
Total Number of Species		31		
Total Number of Hybrid Species		2		
IBI	42			
1 st Pass		42		
2 nd Pass		38		
MIwb	8.7			
1 st Pass		10.3		
2 nd Pass		10.9		
ICI	38	38		

TABLE 4.3.16: (continued)			
Scioto-Downtown Surface Waters Area – Greenlawn Avenue Zone			
Metering and Sampling Data Summary			
Biology – Freshwater Mussels			
Species		Number Living/Number Fresh Dead	
Total Mussels		42/21.5	
Total Species of Mussels		9/7	
<i>Species of Concern</i>			
<i>Anodonta suborbiculata</i> - Flat Floater		3/1	
<i>Threatened Species</i>			
Fawnsfoot (<i>Truncilla donaciformis</i>)		1/1	
<i>Endangered Species</i>			
No endangered species observed		NA	
Bacteria			
Measure	WQS ¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>	1000	70	230
<i>Wet Weather</i>		130	650,000
E. coli			
<i>Dry Weather</i>	126	10	90
<i>Wet Weather</i>		60	1,200,000

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.17:
Scioto-South Columbus Surface Waters Area – State Route 104 Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.450	8.770	7.917
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.010	0.860	0.545
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	2.920	16.090	8.883
Temperature (°C)	30.6 max.	10.690	27.800	20.037
Total Chlorophyll (mg/l)	NA	0.000	131.300	14.867
Turbidity (NTU)	NA	0.000	1,388.500	56.571
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.550	8.460	7.957
Specific Conductivity (µS/cm)	2400 @ 25°C	404.000	806.000	556.545
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	4.600	93.100	8.770
Temperature (°C)	30.6 max.	11.480	27.100	20.358
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	3.700	22.000	7.883
CBOD - 5 Day (mg/l)	NA	2.000	11.000	3.316
Total Chlorophyll (mg/l)	NA	26.490	30.700	28.563
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	BDL	BDL
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	10.100	5.806
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	BDL	BDL
Lead – Total (µg/l)	300 max. 16 average	BDL	13.200	5.617
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.500	0.266
Nickel – Total (µg/l)	840 max. 94 average	BDL	7.500	5.216
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	5.260	5.013

TABLE 4.3.17: (continued)				
Scioto-South Columbus Surface Waters Area – State Route 104 Zone				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	7.840	64.900	25.962
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	44.200	13.752
Phosphorus - Total (mg/l)	NA	0.050	2.700	0.236
Phosphorus –Dissolved (mg/l)	NA	0.050	0.750	0.068
Total Suspended Solids (mg/l)	NA	4.000	550.000	33.708
Total Dissolved Solids (mg/l)	1500 max.	200.000	510.000	340.462
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.400	0.610
Nitrate Nitrite (mg/l)	NA	0.050	3.600	1.036
Ammonia Nitrogen (mg/l)	1.6 max.	0.050	0.660	0.178
Chemistry – Sediment				
Measure	WQS	Minimum		
Cadmium – Total (mg/kg-dry)	NA	1.01		
Chromium – Total (mg/kg-dry)		19.6		
Copper – Total (mg/kg-dry)		37.0		
Lead – Total (mg/kg-dry)		95.0		
Mercury – Total (mg/kg-dry)		0.33		
Nickel – Total (mg/kg-dry)		14.4		
Zinc – Total (mg/kg-dry)		112		
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	100	560	
Dry Weather		160	570,000	
Wet Weather				
E. coli	126	40	350	
Dry Weather		60	320,000	
Wet Weather				
Toxicity				
Measure	WQS	24 Hour Value		
Acute Toxicity		0 mortality, 5% affected		
Dry Weather		0 mortality, 15% affected		
Wet Weather				

¹ 30-day geometric mean values in the current Ohio WQS

**TABLE 4.3.18:
Scioto-South Columbus Surface Waters Area – Jackson Pike Zone
Metering and Sampling Data Summary**

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.290	8.990	8.006
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.244	0.876	0.543
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	1.470	17.210	8.372
Temperature (°C)	30.6 max.	11.310	28.740	21.538
Total Chlorophyll (mg/l)	NA	1.900	143.000	18.937
Turbidity (NTU)	NA	4.700	1,867.800	170.628
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.340	8.460	7.882
Specific Conductivity (µS/cm)	2400 @ 25°C	457.000	936.000	664.645
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	5.790	9.950	8.547
Temperature (°C)	30.6 max.	14.870	24.820	21.342
Acute Toxicity				
Measure	WQS	24 Hour Value		
Acute Toxicity				
Dry Weather		0 mortality, 0% affected		
Wet Weather		0 mortality, 0% affected		

TABLE 4.3.19:
Scioto-South Columbus Surface Waters Area – Interstate 270 Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.230	8.680	7.771
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.279	0.995	0.623
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	4.570	15.490	8.497
Temperature (°C)	30.6 max.	11.930	27.250	21.383
Total Chlorophyll (mg/l)	NA	0.000	121.000	10.912
Turbidity (NTU)	NA	0.000	1,814.000	127.039
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.510	8.650	7.823
Specific Conductivity (µS/cm)	2400 @ 25°C	418.000	1,015.000	688.267
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	4.820	12.290	7.770
Temperature (°C)	30.6 max.	12.140	26.800	20.557
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	4.100	10.000	6.892
CBOD - 5 Day (mg/l)	NA	2.000	5.500	2.651
Total Chlorophyll (mg/l)	NA	2.500	25.000	14.090
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	2.700	5.000	4.894
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	2.700	9.650	5.630
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	BDL	BDL
Lead – Total (µg/l)	300 max. 16 average	1.200	11.400	5.437
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.500	0.258
Nickel – Total (µg/l)	840 max. 94 average	4.400	8.070	5.393
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	9.480	5.240

TABLE 4.3.19: (continued)
Scioto-South Columbus Surface Waters Area – Interstate 270 Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	17.100	62.500	32.852
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	31.800	19.419
Phosphorus - Total (mg/l)	NA	0.050	4.400	0.547
Phosphorus –Dissolved (mg/l)	NA	0.050	1.300	0.331
Total Suspended Solids (mg/l)	NA	4.000	97.000	27.397
Total Dissolved Solids (mg/l)	1500 max.	200.000	630.000	407.778
Total Kjeldahl Nitrogen (mg/l)	NA	0.100	1.400	0.646
Nitrate Nitrite (mg/l)	NA	0.700	5.100	2.445
Ammonia Nitrogen (mg/l)	1.6 max.	0.050	0.590	0.148
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.86		
Chromium – Total (mg/kg-dry)		31.3		
Copper – Total (mg/kg-dry)		27.7		
Lead – Total (mg/kg-dry)		57.0		
Mercury – Total (mg/kg-dry)		0.10		
Nickel – Total (mg/kg-dry)		18.2		
Zinc – Total (mg/kg-dry)		137		
Biology – Freshwater Mussels				
Species		Number Living/Number Fresh Dead		
Total Mussels		37/42		
Total Species of Mussels		7/9		
Species of Concern				
Truncilla truncata - Deertoe		0/1		
Threatened Species				
Obliquaria reflexa - Three-horn Wartyback		1/1		
Truncilla donaciformis - Fawnsfoot		1/1		
Endangered Species				
No Endangered Species Observed		NA		

TABLE 4.3.19: (continued) Scioto-South Columbus Surface Waters Area – Interstate 270 Zone Metering and Sampling Data Summary			
Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		300	5200
<i>Wet Weather</i>	1000	250	540,000
E. coli			
<i>Dry Weather</i>		60	4500
<i>Wet Weather</i>	126	130	300,000

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.20:
Upper Alum Creek Surface Waters Area – Cleveland Avenue Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	5.200	8.240	7.446
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.001	0.607	0.467
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	5.74	10.760	7.635
Temperature (°C)	29.4 max.	14.760	25.940	20.014
Total Chlorophyll (mg/l)	NA	-0.500	38.300	2.868
Turbidity (NTU)	NA	0	1,786.100	38.652
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	0.360	8.090	7.377
Specific Conductivity (µS/cm)	2400 @ 25°C	326.000	616.000	477.206
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	5.780	11.200	7.827
Temperature (°C)	29.4 max.	10.560	26.010	19.175
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.100	13.000	5.153
CBOD - 5 Day (mg/l)	NA	2.000	3.500	2.105
Total Chlorophyll (mg/l)	NA	0.710	1.220	0.958
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	16.900	5.407
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	389.000	45.511
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	19.200	6.598
Lead – Total (µg/l)	300 max. 16 average	BDL	18.700	5.785
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.730	0.259
Nickel – Total (µg/l)	840 max. 94 average	BDL	40.000	7.418
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	5.130	5.005

TABLE 4.3.20: (continued)
Upper Alum Creek Surface Waters Area – Cleveland Avenue Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	6.950	160.000	34.108
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	42.200	13.087
Phosphorus - Total (mg/l)	NA	0.050	0.780	0.120
Phosphorus –Dissolved (mg/l)	NA	0.050	0.120	0.054
Total Suspended Solids (mg/l)	NA	6.000	760.000	79.000
Total Dissolved Solids (mg/l)	1500	1.000	380.000	277.014
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	2.000	0.433
Nitrate Nitrite (mg/l)	NA	0.050	1.200	0.762
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.190	0.074
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.83		
Chromium – Total (mg/kg-dry)		21.6		
Copper – Total (mg/kg-dry)		53.0		
Lead – Total (mg/kg-dry)		31.4		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		45.4		
Zinc – Total (mg/kg-dry)		136		
Biology				
Measure	WQS	Score		
QHEI	NA	75.0		
Total Number of Species	NA	33		
Total Number of Hybrid Species	NA	1		
IBI	40			
1 st Pass		40		
2 nd Pass		42		
MIwb	8.5			
1 st Pass		9.4		
2 nd Pass		8.3		
ICI	38	46		

TABLE 4.3.20: (continued) Upper Alum Creek Surface Waters Area – Cleveland Avenue Zone Metering and Sampling Data Summary			
Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		470	1300
<i>Wet Weather</i>	1000	60	90,000
E. coli			
<i>Dry Weather</i>		260	930
<i>Wet Weather</i>	126	40	32,000

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.21:
Upper Alum Creek Surface Waters Area – State Route 3 Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.310	8.890	7.785
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.177	0.768	0.493
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	5.400	12.920	8.614
Temperature (°C)	29.4 max.	15.710	25.540	20.597
Total Chlorophyll (mg/l)	NA	0.020	485.861	3.577
Turbidity (NTU)	NA	0.200	1,365.600	28.716
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.020	8.180	7.819
Specific Conductivity (µS/cm)	2400 @ 25°C	194.000	826.000	555.518
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	1.000	11.440	8.376
Temperature (°C)	29.4 max.	10.560	26.120	19.267
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.500	18.000	5.393
CBOD - 5 Day (mg/l)	NA	2.000	3.000	2.089
Total Chlorophyll (mg/l)	NA	0.510	0.920	0.713
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	14.700	5.143
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	8.600	5.156
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	369.000	53.410
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	21.700	6.991
Lead – Total (µg/l)	300 max. 16 average	BDL	15.800	5.441
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.660	0.268
Nickel – Total (µg/l)	840 max. 94 average	BDL	18.400	6.531
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	6.790	5.194

TABLE 4.3.21: (continued)				
Upper Alum Creek Surface Waters Area – State Route 3 Zone				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	6.000	100.000	36.389
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	39.600	21.003
Phosphorus - Total (mg/l)	NA	0.050	2.100	0.476
Phosphorus –Dissolved (mg/l)	NA	0.050	1.500	0.365
Total Suspended Solids (mg/l)	NA	4.000	380.000	56.941
Total Dissolved Solids (mg/l)	1500	130.000	460.000	321.912
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.700	0.457
Nitrate Nitrite (mg/l)	NA	0.450	5.400	1.998
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.190	0.069
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.66		
Chromium – Total (mg/kg-dry)		0.66		
Copper – Total (mg/kg-dry)		20.3		
Lead – Total (mg/kg-dry)		31.4		
Mercury – Total (mg/kg-dry)		0.33		
Nickel – Total (mg/kg-dry)		37.4		
Zinc – Total (mg/kg-dry)		148		
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	80	480	
Dry Weather		110	130,000	
Wet Weather	126			
E. coli				
Dry Weather		70	330	
Wet Weather		70	110,000	

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.22:
Upper Alum Creek Surface Waters Area – Mock Road Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.510	8.360	7.942
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.232	0.858	0.523
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	5.400	12.920	8.614
Temperature (°C)	29.4 max.	10.090	25.660	19.054
Total Chlorophyll (mg/l)	NA	0.000	161.700	3.880
Turbidity (NTU)	NA	0.000	932.400	32.705
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.020	8.180	7.819
Specific Conductivity (µS/cm)	2400 @ 25°C	194.000	826.000	555.518
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	1.00	11.440	8.376
Temperature (°C)	29.4 max.	10.560	26.120	19.267
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.500	12.000	12.000
CBOD - 5 Day (mg/l)	NA	2.000	3.800	2.234
Total Chlorophyll (mg/l)	NA	0.500	0.920	0.780
Cadmium – Total (µg/l)	9.9 max. 4.2 average	2.000	3.800	2.234
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	15.800	5.341
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	5.600	5.022
Copper – Total (µg/l)	27 max. 17 average	BDL	295.000	41.232
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	25.000	6.609
Lead – Total (µg/l)	300 max. 16 average	BDL	19.800	6.109
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.580	0.266
Nickel – Total (µg/l)	840 max. 94 average	BDL	20.000	6.945
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	7.340	5.329

TABLE 4.3.22: (continued)				
Upper Alum Creek Surface Waters Area – Mock Road Zone				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	8.370	99.700	36.580
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	47.000	18.087
Phosphorus - Total (mg/l)	NA	0.050	4.500	0.372
Phosphorus –Dissolved (mg/l)	NA	0.050	0.760	0.211
Total Suspended Solids (mg/l)	NA	2.000	400.000	63.394
Total Dissolved Solids (mg/l)	1500	5.000	490.000	300.273
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.800	0.502
Nitrate Nitrite (mg/l)	NA	0.320	3.700	1.385
Ammonia Nitrogen (mg/l)	1.5 max.	0.510	0.050	0.074
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	<0.50		
Chromium – Total (mg/kg-dry)		12.0		
Copper – Total (mg/kg-dry)		23.2		
Lead – Total (mg/kg-dry)		26.7		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		24.6		
Zinc – Total (mg/kg-dry)		104		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	76.5		
Total Number of Species	NA	24		
Total Number of Hybrid Species	NA	2		
IBI	40			
1 st Pass		44		
2 nd Pass		44		
MIwb	8.5			
1 st Pass		8.6		
2 nd Pass		8.2		
ICI	38	20		

TABLE 4.3.22: (continued) Upper Alum Creek Surface Waters Area – Mock Road Zone Metering and Sampling Data Summary			
Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		140	830
<i>Wet Weather</i>	1000	170	>780,000
E. coli			
<i>Dry Weather</i>		60	750
<i>Wet Weather</i>	126	70	>780,600

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.23:
Lower Alum Creek Surface Waters Area – Main Street Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.290	8.070	7.701
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.219	0.876	0.519
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	5.440	11.350	7.982
Temperature (°C)	29.4 max.	10.880	26.670	20.324
Total Chlorophyll (mg/l)	NA	0.000	104.100	4.304
Turbidity (NTU)	NA	0.000	1,908.200	42.338
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.380	8.210	7.739
Specific Conductivity (µS/cm)	2400 @ 25°C	227.000	875.000	605.283
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	5.830	10.670	8.007
Temperature (°C)	29.4 max.	10.880	26.670	20.324
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.600	11.000	5.758
CBOD - 5 Day (mg/l)	NA	2.000	3.600	2.155
Total Chlorophyll (mg/l)	NA	0.610	0.720	0.680
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	7.270	5.085
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	64.700	8.310
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	BDL	BDL
Lead – Total (µg/l)	300 max. 16 average	BDL	38.600	7.072
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.910	0.276
Nickel – Total (µg/l)	840 max. 94 average	BDL	16.200	6.405
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	6.480	5.177

TABLE 4.3.23: (continued)				
Lower Alum Creek Surface Waters Area – Main Street Zone				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	10.300	271.000	42.788
Zinc – Dissolved (µg/l)	210 max. 210 average	7.710	39.200	18.474
Phosphorus - Total (mg/l)	NA	0.050	1.500	0.292
Phosphorus –Dissolved (mg/l)	NA	0.050	0.840	0.167
Total Suspended Solids (mg/l)	NA	2.000	390.000	50.111
Total Dissolved Solids (mg/l)	1500	22.000	500.000	311.500
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.400	0.471
Nitrate Nitrite (mg/l)	NA	0.480	2.800	1.218
Ammonia Nitrogen (mg/l)	1.5 max.	0.000	0.250	0.076
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.77		
Chromium – Total (mg/kg-dry)		14.4		
Copper – Total (mg/kg-dry)		24.6		
Lead – Total (mg/kg-dry)		45.0		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		21.1		
Zinc – Total (mg/kg-dry)		130		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	65.0		
Total Number of Species	NA	29		
Total Number of Hybrid Species	NA	4		
IBI	42			
1 st Pass		34		
2 nd Pass		38		
MIwb	8.7			
1 st Pass		9.3		
2 nd Pass		9.7		
ICI	38	38		

TABLE 4.3.23: (continued)			
Lower Alum Creek Surface Waters Area – Main Street Zone			
Metering and Sampling Data Summary			
Biology – Freshwater Mussels			
Species		Number Living/Number Fresh Dead	
Total Mussels		2/0	
Total Species of Mussels			
<i>Species of Concern</i>			
No species of concern observed		NA	
<i>Threatened Species</i>			
No threatened species observed		NA	
<i>Endangered Species</i>			
No endangered species observed		NA	
Bacteria			
Measure	WQS ¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>	1000	380	2400
<i>Wet Weather</i>		140	160,000
E. coli			
<i>Dry Weather</i>	126	310	1200
<i>Wet Weather</i>		60	30,000
Acute Toxicity			
Measure	WQS	24 Hour Value	
Acute Toxicity			
<i>Dry Weather</i>		0 mortality, 5% affected	
<i>Wet Weather</i>		0 mortality, 0% affected	

¹ 30-day geometric mean values in the current Ohio WQS

**TABLE 4.3.24:
Lower Alum Creek Surface Waters Area – Livingston Avenue Zone
Metering and Sampling Data Summary**

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.420	8.020	7.775
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.174	0.900	0.548
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	4.520	12.220	8.184
Temperature (°C)	29.4 max.	10.660	26.230	19.674
Total Chlorophyll (mg/l)	NA	0.000	169.200	3.160
Turbidity (NTU)	NA	0.000	1,888.000	31.641
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.42	8.320	7.545
Specific Conductivity (µS/cm)	2400 @ 25°C	232.000	894.000	587.333
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	5.280	10.520	7.863
Temperature (°C)	29.4 max.	10.650	25.780	19.591
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.200	12.000	6.094
CBOD - 5 Day (mg/l)	NA	2.000	3.500	2.178
Total Chlorophyll (mg/l)	NA	0.510	25.500	6.808
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	7.630	5.103
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	25.100	7.743
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	16.500	5.462
Lead – Total (µg/l)	300 max. 16 average	BDL	44.900	7.660
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	1.100	0.280
Nickel – Total (µg/l)	840 max. 94 average	BDL	17.600	6.341
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	5.840	5.155

TABLE 4.3.24: (continued)				
Lower Alum Creek Surface Waters Area – Livingston Avenue Zone				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	8.070	111.000	34.152
Zinc – Dissolved (µg/l)	210 max. 210 average	6.620	33.200	16.760
Phosphorus - Total (mg/l)	NA	0.050	3.100	0.324
Phosphorus –Dissolved (mg/l)	NA	0.050	0.860	0.144
Total Suspended Solids (mg/l)	NA	1.000	430.000	51.785
Total Dissolved Solids (mg/l)	1500	140.000	550.000	312.308
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	2.000	0.494
Nitrate Nitrite (mg/l)	NA	0.420	2.600	1.128
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.160	0.070
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.89		
Chromium – Total (mg/kg-dry)		13.6		
Copper – Total (mg/kg-dry)		27.6		
Lead – Total (mg/kg-dry)		36.7		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		20.0		
Zinc – Total (mg/kg-dry)		130		
Biology – Freshwater Mussels				
Species	Number Living/Number Fresh Dead			
Total Mussels	0/0			
Total Species of Mussels	0/0			
Species of Concern				
No species of concern observed	NA			
Threatened Species				
No threatened species observed	NA			
Endangered Species				
No endangered species observed	NA			
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	100	3800	
Dry Weather		120	290,000	
Wet Weather	126	340	3600	
E. coli		40	68,000	
Dry Weather				
Wet Weather				

TABLE 4.3.24: (continued) Lower Alum Creek Surface Waters Area – Livingston Avenue Zone Metering and Sampling Data Summary		
Acute Toxicity		
Measure	WQS	24 Hour Value
Acute Toxicity		
<i>Dry Weather</i>		0 mortality, 5% affected
<i>Wet Weather</i>		0 mortality, 0% affected

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.25:
Three Rivers Surface Waters Area – State Route 104 Zone (Alum Creek)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.360	8.630	7.761
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.186	0.969	0.575
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	3.690	20.640	8.377
Temperature (°C)	29.4 max.	10.520	27.390	19.615
Total Chlorophyll (mg/l)	NA	0.000	111.200	4.452
Turbidity (NTU)	NA	0.000	1,533.600	38.282
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.430	7.990	7.737
Specific Conductivity (µS/cm)	2400 @ 25°C	189.000	952.000	643.156
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	4.670	11.610	8.379
Temperature (°C)	29.4 max.	4.750	25.000	18.381
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.800	10.000	5.833
CBOD - 5 Day (mg/l)	NA	2.000	3.600	2.171
Total Chlorophyll (mg/l)	NA	1.020	1.640	1.397
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	6.940	5.072
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	27.500	7.544
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	BDL	BDL
Lead – Total (µg/l)	300 max. 16 average	BDL	30.400	7.161
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.050	0.950	0.262
Nickel – Total (µg/l)	840 max. 94 average	BDL	15.300	6.259
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	6.090	5.111

TABLE 4.3.25: (continued)				
Three Rivers Surface Waters Area – State Route 104 Zone (Alum Creek)				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	6.780	96.200	30.071
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	22.600	12.719
Phosphorus - Total (mg/l)	NA	0.050	13.000	0.428
Phosphorus –Dissolved (mg/l)	NA	0.050	0.590	0.108
Total Suspended Solids (mg/l)	NA	4.000	340.000	53.852
Total Dissolved Solids (mg/l)	1500	110.000	560.000	308.852
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	2.000	0.504
Nitrate Nitrite (mg/l)	NA	0.050	2.200	0.965
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.250	0.100
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	1.09		
Chromium – Total (mg/kg-dry)		28.4		
Copper – Total (mg/kg-dry)		37.8		
Lead – Total (mg/kg-dry)		70.5		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		25.6		
Zinc – Total (mg/kg-dry)		145		
Bacteria				
Measure	WQS ¹	Minimum	Maximum	
Fecal Coliform	1000	90	440	
Dry Weather		180	140,000	
Wet Weather				
E. coli	126	60	150	
Dry Weather		120	120,000	
Wet Weather				

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.26:
Three Rivers Surface Waters Area – Williams Road Zone (Alum Creek)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.440	8.700	7.861
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.200	1.013	0.639
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	4.290	22.510	8.787
Temperature (°C)	29.4 max.	6.870	26.040	19.567
Total Chlorophyll (mg/l)	NA	0.000	78.200	4.151
Turbidity (NTU)	NA	0.000	761.100	33.972
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.420	8.250	7.767
Specific Conductivity (µS/cm)	2400 @ 25°C	226.000	963.000	613.827
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	4.750	12.650	7.932
Temperature (°C)	29.4 max.	6.970	25.680	19.215
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.600	13.000	5.939
CBOD - 5 Day (mg/l)	NA	2.000	16.000	2.486
Total Chlorophyll (mg/l)	NA	0.500	1.120	0.780
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	8.020	5.080
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	15.600	6.958
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	BDL	BDL
Lead – Total (µg/l)	300 max. 16 average	BDL	22.100	6.865
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.920	0.269
Nickel – Total (µg/l)	840 max. 94 average	BDL	14.600	6.353
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	6.770	5.178

TABLE 4.3.26: (continued)
Three Rivers Surface Waters Area – Williams Road Zone (Alum Creek)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	9.230	93.700	32.635
Zinc – Dissolved (µg/l)	210 max. 210 average	6.200	34.000	15.003
Phosphorus - Total (mg/l)	NA	0.050	0.890	0.192
Phosphorus –Dissolved (mg/l)	NA	0.050	0.680	0.095
Total Suspended Solids (mg/l)	NA	2.000	360.000	57.000
Total Dissolved Solids (mg/l)	1500	140.000	550.000	310.156
Total Kjeldahl Nitrogen (mg/l)	NA	0.050	2.100	0.444
Nitrate Nitrite (mg/l)	NA	0.060	2.600	0.945
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.260	0.083
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.85		
Chromium – Total (mg/kg-dry)		15.8		
Copper – Total (mg/kg-dry)		48.1		
Lead – Total (mg/kg-dry)		60.5		
Mercury – Total (mg/kg-dry)		0.48		
Nickel – Total (mg/kg-dry)		30.4		
Zinc – Total (mg/kg-dry)		127		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	70.5		
Total Number of Species	NA	23		
Total Number of Hybrid Species	NA	1		
IBI	42			
1 st Pass		30		
2 nd Pass		32		
MIwb	8.7			
1 st Pass		7.7		
2 nd Pass		8.0		
ICI	38	36		

TABLE 4.3.26: (continued) Three Rivers Surface Waters Area – Williams Road Zone (Alum Creek) Metering and Sampling Data Summary			
Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		70	200
<i>Wet Weather</i>	1000	90	140,000
E. coli			
<i>Dry Weather</i>		1	120
<i>Wet Weather</i>	126	50	89,000

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.27:
Three Rivers Surface Waters Area – Winchester Pike Zone (Blacklick Creek)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	6.770	8.520	7.736
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.017	1.628	0.784
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	3.380	18.070	8.605
Temperature (°C)	29.4 max.	5.930	25.320	18.572
Total Chlorophyll (mg/l)	NA	0.000	286.900	11.172
Turbidity (NTU)	NA	0.100	1,439.200	28.012
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.070	8.350	7.880
Specific Conductivity (µS/cm)	2400 @ 25°C	166.000	1,376.000	761.418
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	4.500	13.550	8.512
Temperature (°C)	29.4 max.	6.850	24.720	18.701
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.400	14.000	6.898
CBOD - 5 Day (mg/l)	NA	2.000	5.500	2.485
Total Chlorophyll (mg/l)	NA	BDL	10.900	5.344
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	10.900	5.344
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	5.040	5.002
Copper – Total (µg/l)	27 max. 17 average	BDL	21.300	7.735
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	BDL	BDL
Lead – Total (µg/l)	300 max. 16 average	BDL	24.900	6.480
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	1.100	0.278
Nickel – Total (µg/l)	840 max. 94 average	BDL	23.800	6.728
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	6.580	5.073

TABLE 4.3.27: (continued)				
Three Rivers Surface Waters Area – Winchester Pike Zone (Blacklick Creek)				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	10.000	164.000	31.036
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	23.800	10.741
Phosphorus - Total (mg/l)	NA	0.050	0.790	0.227
Phosphorus –Dissolved (mg/l)	NA	0.050	0.390	0.103
Total Suspended Solids (mg/l)	NA	2.000	780.000	80.682
Total Dissolved Solids (mg/l)	1500	110.000	790.000	361.212
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	2.600	0.554
Nitrate Nitrite (mg/l)	NA	0.400	2.400	0.946
Ammonia Nitrogen (mg/l)	1.5 max.	0.050	0.400	0.079
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.64		
Chromium – Total (mg/kg-dry)		10.3		
Copper – Total (mg/kg-dry)		21.0		
Lead – Total (mg/kg-dry)		18.4		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		18.0		
Zinc – Total (mg/kg-dry)		71.5		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	83.5		
Total Number of Species		26		
Total Number of Hybrid Species		2		
IBI	40			
1 st Pass		42		
2 nd Pass		46		
MIwb	8.5			
1 st Pass		7.6		
2 nd Pass		8.1		
ICI	38	52		

TABLE 4.3.27: (continued) Three Rivers Surface Waters Area – Winchester Pike Zone (Blacklick Creek) Metering and Sampling Data Summary			
Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		150	380
<i>Wet Weather</i>	1000	120	77,000
E. coli			
<i>Dry Weather</i>		120	190
<i>Wet Weather</i>	126	100	32,000

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.28:
Three Rivers Surface Waters Zone – Williams Road Zone (Big Walnut Creek)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.460	9.030	7.907
Specific Conductivity (mS/cm)	2.4 @ 25°C	6.980	26.260	18.599
Dissolved Oxygen (mg/l)	5.0 min. 6.0 average	5.370	17.290	8.779
Temperature (°C)	29.4 max.	6.980	26.260	18.599
Total Chlorophyll (mg/l)	NA	0.000	445.900	8.541
Turbidity (NTU)	NA	0.100	1,979.400	16.970
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.480	8.220	7.845
Specific Conductivity (µS/cm)	2400 @ 25°C	44.000	748.000	508.847
Dissolved Oxygen (mg/l)	5.0 min 6.0 average	5.320	12.240	8.265
Temperature (°C)	29.4 max.	8.330	25.180	18.954
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.600	15.000	5.616
CBOD - 5 Day (mg/l)	NA	2.000	4.400	2.166
Total Chlorophyll (mg/l)	NA	0.820	1.530	1.090
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	8.470	5.123
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	15.900	6.629
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	BDL	BDL
Lead – Total (µg/l)	300 max. 16 average	BDL	17.400	6.105
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.890	0.275
Nickel – Total (µg/l)	840 max. 94 average	BDL	14.700	5.788
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	BDL	BDL

TABLE 4.3.28: (continued)				
Three Rivers Surface Waters Zone – Williams Road Zone (Big Walnut Creek)				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	7.840	83.600	29.978
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	24.800	11.038
Phosphorus - Total (mg/l)	NA	0.050	0.810	0.131
Phosphorus –Dissolved (mg/l)	NA	0.050	0.180	0.054
Total Suspended Solids (mg/l)	NA	4.000	260.000	51.081
Total Dissolved Solids (mg/l)	1500	94.000	420.000	262.000
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.600	0.420
Nitrate Nitrite (mg/l)	NA	0.260	1.800	0.548
Ammonia Nitrogen (mg/l)	0.9 max.	0.050	0.230	0.070
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	1.55		
Chromium – Total (mg/kg-dry)		21.6		
Copper – Total (mg/kg-dry)		28.1		
Lead – Total (mg/kg-dry)		35.4		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		26.3		
Zinc – Total (mg/kg-dry)		120		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	88.5		
Total Number of Species		42		
Total Number of Hybrid Species		2		
IBI	50			
1 st Pass		50		
2 nd Pass		48		
MIwb	9.5			
1 st Pass		10.3		
2 nd Pass		9.6		
ICI	48	42		

TABLE 4.3.28: (continued) Three Rivers Surface Waters Zone – Williams Road Zone (Big Walnut Creek) Metering and Sampling Data Summary			
Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		40	350
<i>Wet Weather</i>	1000	190	100,000
E. coli			
<i>Dry Weather</i>		30	170
<i>Wet Weather</i>	126	60	53,000

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.29:
Three Rivers Surface Waters Area – Reese Road Zone (Big Walnut Creek)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.270	8.670	7.852
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.198	0.855	0.564
Dissolved Oxygen (mg/l)	5.0 min. 6.0 average	4.910	11.670	7.925
Temperature (°C)	29.4 max.	10.020	26.230	20.089
Total Chlorophyll (mg/l)	NA	0.000	226.300	3.728
Turbidity (NTU)	NA	0.000	1,411.500	74.136
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.270	8.090	7.802
Specific Conductivity (µS/cm)	2400 @ 25°C	231.000	822.000	579.885
Dissolved Oxygen (mg/l)	5.0 min 6.0 average	4.790	10.610	7.716
Temperature (°C)	29.4 max.	10.150	25.770	19.616
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.000	13.000	5.388
CBOD - 5 Day (mg/l)	NA	2.000	3.800	2.127
Total Chlorophyll (mg/l)	NA	0.310	1.830	0.933
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	8.600	5.105
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	6.930	5.060
Copper – Total (µg/l)	27 max. 17 average	BDL	17.600	7.136
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	BDL	BDL
Lead – Total (µg/l)	300 max. 16 average	BDL	42.000	7.593
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	1.200	0.261
Nickel – Total (µg/l)	840 max. 94 average	BDL	13.500	6.236
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	6.060	5.087

TABLE 4.3.29: (continued)
Three Rivers Surface Waters Area – Reese Road Zone (Big Walnut Creek)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	8.770	148.000	32.959
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	20.800	11.652
Phosphorus - Total (mg/l)	NA	0.050	1.500	0.195
Phosphorus –Dissolved (mg/l)	NA	0.050	0.350	0.064
Total Suspended Solids (mg/l)	NA	4.000	350.000	59.347
Total Dissolved Solids (mg/l)	1500	130.000	460.000	292.842
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.300	0.410
Nitrate Nitrite (mg/l)	NA	0.450	1.400	0.710
Ammonia Nitrogen (mg/l)	0.9 max.	0.050	0.200	0.065
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	1.12		
Chromium – Total (mg/kg-dry)		12.2		
Copper – Total (mg/kg-dry)		23.9		
Lead – Total (mg/kg-dry)		34.7		
Mercury – Total (mg/kg-dry)		0.33		
Nickel – Total (mg/kg-dry)		26.3		
Zinc – Total (mg/kg-dry)		108		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	83.0		
Total Number of Species	NA	37		
Total Number of Hybrid Species	NA	1		
IBI	50			
1 st Pass		46		
2 nd Pass		54		
MIwb	9.5			
1 st Pass		10.4		
2 nd Pass		10.0		
ICI	48	46		

TABLE 4.3.29: (continued) Three Rivers Surface Waters Area – Reese Road Zone (Big Walnut Creek) Metering and Sampling Data Summary			
Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		120	280
<i>Wet Weather</i>	1000	160	63,000
E. coli			
<i>Dry Weather</i>		40	560
<i>Wet Weather</i>	126	1	51,000

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.30:
Scioto-Big Walnut Confluence Surface Waters Area
– Rowe Road Zone (Big Walnut Creek)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.110	8.480	7.825
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.244	0.844	0.541
Dissolved Oxygen (mg/l)	5.0 min. 6.0 average	5.220	14.430	8.463
Temperature (°C)	29.4 max.	10.050	27.110	20.316
Total Chlorophyll (mg/l)	NA	0.000	500.000	7.776
Turbidity (NTU)	NA	0.000	1,403.500	16.489
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.000	8.380	7.883
Specific Conductivity (µS/cm)	2400 @ 25°C	230.000	775.000	577.393
Dissolved Oxygen (mg/l)	5.0 min 6.0 average	5.500	13.990	8.296
Temperature (°C)	29.4 max.	8.680	26.070	19.767
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	3.100	12.000	5.395
CBOD - 5 Day (mg/l)	NA	2.000	3.200	2.037
Total Chlorophyll (mg/l)	NA	0.610	1.630	1.040
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	0.920	7.490	4.996
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	2.000	15.700	6.360
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	BDL	BDL
Lead – Total (µg/l)	300 max. 16 average	BDL	20.100	5.911
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	1.500	0.270
Nickel – Total (µg/l)	840 max. 94 average	BDL	12.900	6.081

TABLE 4.3.30: (continued)
Scioto-Big Walnut Confluence Surface Waters Area
– Rowe Road Zone (Big Walnut Creek)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	6.520	5.115
Zinc – Total (µg/l)	220 max. 220 average	3.400	93.000	26.480
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	48.300	13.783
Phosphorus - Total (mg/l)	NA	0.050	1.600	0.188
Phosphorus –Dissolved (mg/l)	NA	0.050	0.210	0.063
Total Suspended Solids (mg/l)	NA	4.000	290.000	61.000
Total Dissolved Solids (mg/l)	1500	5.000	580.000	302.829
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	2.200	0.396
Nitrate Nitrite (mg/l)	NA	0.050	1.100	0.665
Ammonia Nitrogen (mg/l)	0.9 max.	0.050	0.230	0.059
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.89		
Chromium – Total (mg/kg-dry)		12.8		
Copper – Total (mg/kg-dry)		20.8		
Lead – Total (mg/kg-dry)		<1.0		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		21.6		
Zinc – Total (mg/kg-dry)		99.5		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	91.5		
Total Number of Species	NA	35		
Total Number of Hybrid Species	NA	1		
IBI	50	46		
1 st Pass		NA		
2 nd Pass		NA		
MIwb	9.5	11.0		
1 st Pass		NA		
2 nd Pass		NA		
ICI	48	50		

TABLE 4.3.30: (continued)
Scioto-Big Walnut Confluence Surface Waters Area
– Rowe Road Zone (Big Walnut Creek)
Metering and Sampling Data Summary

Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		10	110
<i>Wet Weather</i>	1000	1	120,000
E. coli			
<i>Dry Weather</i>		1	60
<i>Wet Weather</i>	126	1	100,000

¹ 30-day geometric mean values in the current Ohio WQS

**TABLE 4.3.31:
Scioto-Big Walnut Confluence Surface Waters Area – State Route 665 Zone (Scioto River)
Metering and Sampling Data Summary**

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.430	8.470	7.765
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.256	1.025	0.663
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	4.120	12.190	7.664
Temperature (°C)	30.6 max.	11.140	26.620	21.170
Total Chlorophyll (mg/l)	NA	2.300	55.600	9.408
Turbidity (NTU)	NA	0.400	1,490.200	139.928
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.540	8.470	7.846
Specific Conductivity (µS/cm)	2400 @ 25°C	413.000	957.000	681.305
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	4.750	11.650	7.796
Temperature (°C)	30.6 max.	11.410	26.510	21.110
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.000	12.000	6.785
CBOD - 5 Day (mg/l)	NA	2.000	4.700	2.457
Total Chlorophyll (mg/l)	NA	14.260	21.900	17.677
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	11.300	5.216
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	20.900	6.680
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	8.090	5.109
Lead – Total (µg/l)	300 max. 16 average	BDL	20.600	6.264
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	7.260	4.942
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	1.500	0.268
Nickel – Total (µg/l)	840 max. 94 average	BDL	21.100	6.235
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	6.940	5.182

TABLE 4.3.31: (continued)
Scioto-Big Walnut Confluence Surface Waters Area – State Route 665 Zone (Scioto River)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	11.700	101.000	37.399
Zinc – Dissolved (µg/l)	210 max. 210 average	7.870	41.000	19.085
Phosphorus - Total (mg/l)	NA	0.050	5.200	0.526
Phosphorus –Dissolved (mg/l)	NA	0.050	1.400	0.264
Total Suspended Solids (mg/l)	NA	4.000	630.000	53.203
Total Dissolved Solids (mg/l)	1500 max.	220.000	610.000	397.432
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	2.200	0.631
Nitrate Nitrite (mg/l)	NA	0.050	4.400	2.196
Ammonia Nitrogen (mg/l)	1.6 max.	0.050	0.410	0.121
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.56		
Chromium – Total (mg/kg-dry)		13.3		
Copper – Total (mg/kg-dry)		21.7		
Lead – Total (mg/kg-dry)		22.4		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		18.0		
Zinc – Total (mg/kg-dry)		78.5		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	82.5		
Total Number of Species	NA	44		
Total Number of Hybrid Species	NA	2		
IBI	42			
1 st Pass		46		
2 nd Pass		44		
MIwb	8.7			
1 st Pass		11.2		
2 nd Pass		10.9		
ICI	38	38		

TABLE 4.3.31: (continued)
Scioto-Big Walnut Confluence Surface Waters Area – State Route 665 Zone (Scioto River)
Metering and Sampling Data Summary

Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		320	2600
<i>Wet Weather</i>	1000	230	490,000
E. coli			
<i>Dry Weather</i>		180	2400
<i>Wet Weather</i>	126	20	280,000

¹ 30-day geometric mean values in the current Ohio WQS

TABLE 4.3.32:
Scioto-Big Walnut Confluence Surface Waters Area – State Route 762 Zone (Scioto River)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.510	8.530	7.785
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.205	0.948	0.687
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	5.890	14.500	8.197
Temperature (°C)	30.6 max.	11.280	28.500	21.260
Total Chlorophyll (mg/l)	NA	0.000	206.800	12.555
Turbidity (NTU)	NA	1.200	1,411.800	17.210
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.470	8.400	7.817
Specific Conductivity (µS/cm)	2400 @ 25°C	8.570	897.000	675.024
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	2.930	14.840	7.772
Temperature (°C)	30.6 max.	11.340	27.730	20.707
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	2.000	10.000	5.880
CBOD - 5 Day (mg/l)	NA	2.000	3.300	2.122
Total Chlorophyll (mg/l)	NA	11.410	15.800	13.460
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	BDL	7.030	5.058
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	BDL	27.700	6.299
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	5.970	5.033
Lead – Total (µg/l)	300 max. 16 average	BDL	15.600	5.964
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	3.500	0.306
Nickel – Total (µg/l)	840 max. 94 average	BDL	11.200	5.847
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	6.310	5.047

TABLE 4.3.32: (continued)
Scioto-Big Walnut Confluence Surface Waters Area – State Route 762 Zone (Scioto River)
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	17.800	72.500	33.472
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	41.900	17.229
Phosphorus - Total (mg/l)	NA	0.050	1.500	0.398
Phosphorus –Dissolved (mg/l)	NA	0.050	1.300	0.273
Total Suspended Solids (mg/l)	NA	4.000	280.000	44.068
Total Dissolved Solids (mg/l)	1500 max.	5.000	550.000	392.500
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.600	0.585
Nitrate Nitrite (mg/l)	NA	0.050	5.100	2.726
Ammonia Nitrogen (mg/l)	1.6 max.	0.050	0.470	0.093
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.73		
Chromium – Total (mg/kg-dry)		16.8		
Copper – Total (mg/kg-dry)		22.8		
Lead – Total (mg/kg-dry)		29.2		
Mercury – Total (mg/kg-dry)		0.11		
Nickel – Total (mg/kg-dry)		16.6		
Zinc – Total (mg/kg-dry)		102		
Biology – Freshwater Mussels				
Species		Number Living/Number Fresh Dead		
Total Mussels		92/14.5		
Total Species of Mussels		10/6		
Species of Concern				
Alasmidonta marginata - Elktoe		1/0		
Truncilla truncata - Deertoe		1/1		
Threatened Species				
Truncilla donaciformis - Fawnsfoot		7/7		
Endangered Species				
No Endangered Species Observed		NA		

TABLE 4.3.32: (continued)
Scioto-Big Walnut Confluence Surface Waters Area – State Route 762 Zone (Scioto River)
Metering and Sampling Data Summary

Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		180	570
<i>Wet Weather</i>	1000	220	>200,000
E. coli			
<i>Dry Weather</i>		60	440
<i>Wet Weather</i>	126	60	>200,000

¹ 30-day geometric mean values in the current Ohio WQS

**TABLE 4.3.33:
Scioto-Walnut Confluence Surface Waters Area – State Route 316 Zone
Metering and Sampling Data Summary**

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.360	8.430	7.742
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.343	0.986	0.703
Dissolved Oxygen (mg/l)	4.0 min. 5.0 average	1.250	14.930	8.150
Temperature (°C)	30.6 max.	11.240	27.670	21.338
Total Chlorophyll (mg/l)	NA	0.000	166.600	9.901
Turbidity (NTU)	NA	0.000	1,822.900	29.293
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.470	8.370	7.825
Specific Conductivity (µS/cm)	2400 @ 25°C	369.000	874.000	684.327
Dissolved Oxygen (mg/l)	4.0 min 5.0 average	3.560	15.370	8.248
Temperature (°C)	30.6 max.	11.540	26.830	20.300
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	3.900	10.000	6.120
CBOD - 5 Day (mg/l)	NA	2.000	3.300	2.154
Total Chlorophyll (mg/l)	NA	8.970	16.400	13.390
Cadmium – Total (µg/l)	9.9 max. 4.2 average	BDL	BDL	BDL
Cadmium – Dissolved (µg/l)	9.3 max. 3.9 average	BDL	BDL	BDL
Chromium – Total (µg/l)	3200 max. 150 average	2.300	6.400	5.017
Chromium – Dissolved (µg/l)	1000 max. 130 average	BDL	BDL	BDL
Copper – Total (µg/l)	27 max. 17 average	2.600	12.000	6.198
Copper- Dissolved (µg/l)	26 max. 16 average	BDL	BDL	BDL
Lead – Total (µg/l)	300 max. 16 average	0.560	12.800	5.786
Lead – Dissolved (µg/l)	230 max. 12 average	BDL	BDL	BDL
Mercury – Total (µg/l)	1.7 max. 0.91 average	0.200	0.680	0.257
Nickel – Total (µg/l)	840 max. 94 average	4.000	11.000	6.047
Nickel – Dissolved (µg/l)	840 max. 93 average	BDL	BDL	BDL

TABLE 4.3.33: (continued)				
Scioto-Walnut Confluence Surface Waters Area – State Route 316 Zone				
Metering and Sampling Data Summary				
Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	16.500	62.900	32.238
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	26.300	16.186
Phosphorus - Total (mg/l)	NA	0.050	1.600	0.465
Phosphorus –Dissolved (mg/l)	NA	0.050	1.200	0.255
Total Suspended Solids (mg/l)	NA	4.000	280.000	58.939
Total Dissolved Solids (mg/l)	1500 max.	180.000	570.000	388.939
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	1.800	0.588
Nitrate Nitrite (mg/l)	NA	0.960	5.300	2.682
Ammonia Nitrogen (mg/l)	1.6 max.	0.050	0.400	0.086
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.74		
Chromium – Total (mg/kg-dry)		17.2		
Copper – Total (mg/kg-dry)		25.6		
Lead – Total (mg/kg-dry)		29.8		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		16.4		
Zinc – Total (mg/kg-dry)		116		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	76.0		
Total Number of Species	NA	37		
Total Number of Hybrid Species	NA	3		
IBI	42			
1 st Pass		42		
2 nd Pass		50		
MIwb	8.7			
1 st Pass		10.4		
2 nd Pass		9.9		
ICI	38	50		

TABLE 4.3.33: (continued) Scioto-Walnut Confluence Surface Waters Area – State Route 316 Zone Metering and Sampling Data Summary			
Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		200	490
<i>Wet Weather</i>	1000	200	130,000
E. coli			
<i>Dry Weather</i>		160	300
<i>Wet Weather</i>	126	110	100,000

¹ 30-day geometric mean values in the current Ohio WQS

**TABLE 4.3.34:
Scioto-Little Walnut Confluence Surface Waters Area – Commercial Point Road Zone
Metering and Sampling Data Summary**

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
<i>Metering Data – Continuous Metering</i>				
pH	6.5 – 9.0	7.350	8.740	7.818
Specific Conductivity (mS/cm)	2.4 @ 25°C	0.246	0.905	0.598
	4.0 min.			
Dissolved Oxygen (mg/l)	5.0 average	5.880	24.160	8.553
Temperature (°C)	30.6 max.	11.040	27.490	20.914
Total Chlorophyll (mg/l)	NA	0.000	122.200	15.811
Turbidity (NTU)	NA	0.000	1,403.700	69.402
<i>Metering Data – Field Measured Discrete for Calibration of Continuous Equipment</i>				
pH	6.5 – 9.0	7.020	8.590	7.812
Specific Conductivity (µS/cm)	2400 @ 25°C	22.650	881.000	646.342
	4.0 min			
Dissolved Oxygen (mg/l)	5.0 average	2.830	15.060	7.914
Temperature (°C)	30.6 max.	11.300	25.880	19.673
<i>Sampling Data – Lab Measured</i>				
CBOD - 20 Day (mg/l)	NA	3.000	11.000	6.118
CBOD - 5 Day (mg/l)	NA	2.000	4.100	2.168
Total Chlorophyll (mg/l)	NA	9.370	27.600	20.123
	9.9 max.			
Cadmium – Total (µg/l)	4.2 average	BDL	BDL	BDL
	9.3 max.			
Cadmium – Dissolved (µg/l)	3.9 average	BDL	BDL	BDL
	3200 max.			
Chromium – Total (µg/l)	150 average	BDL	12.500	5.194
	1000 max.			
Chromium – Dissolved (µg/l)	130 average	BDL	BDL	BDL
	27 max.			
Copper – Total (µg/l)	17 average	BDL	24.300	6.432
	26 max.			
Copper- Dissolved (µg/l)	16 average	BDL	BDL	BDL
	300 max.			
Lead – Total (µg/l)	16 average	BDL	25.600	6.221
	230 max.			
Lead – Dissolved (µg/l)	12 average	BDL	BDL	BDL
	1.7 max.			
Mercury – Total (µg/l)	0.91 average	0.200	1.000	0.267
	840 max.			
Nickel – Total (µg/l)	94 average	BDL	30.400	6.693
	840 max.			
Nickel – Dissolved (µg/l)	93 average	BDL	5.510	5.027

TABLE 4.3.34: (continued)
Scioto-Little Walnut Confluence Surface Waters Area – Commercial Point Road Zone
Metering and Sampling Data Summary

Chemistry – Water Column				
Measure	WQS	Minimum	Maximum	Average
Sampling Data – Lab Measured				
Zinc – Total (µg/l)	220 max. 220 average	16.300	101.000	31.061
Zinc – Dissolved (µg/l)	210 max. 210 average	6.000	28.100	14.935
Phosphorus - Total (mg/l)	NA	0.050	3.200	0.446
Phosphorus –Dissolved (mg/l)	NA	0.050	1.000	0.210
Total Suspended Solids (mg/l)	NA	4.000	830.000	69.303
Total Dissolved Solids (mg/l)	1500 max.	120.000	550.000	393.939
Total Kjeldahl Nitrogen (mg/l)	NA	0.200	2.600	0.592
Nitrate Nitrite (mg/l)	NA	0.940	4.900	2.605
Ammonia Nitrogen (mg/l)	1.6 max.	0.050	0.270	0.075
Chemistry – Sediment				
Measure	WQS	Concentration		
Cadmium – Total (mg/kg-dry)	NA	0.70		
Chromium – Total (mg/kg-dry)		16.2		
Copper – Total (mg/kg-dry)		22.0		
Lead – Total (mg/kg-dry)		28.6		
Mercury – Total (mg/kg-dry)		<0.04		
Nickel – Total (mg/kg-dry)		17.0		
Zinc – Total (mg/kg-dry)		104		
Biology – Fish and Macroinvertebrates				
Measure	WQS	Score		
QHEI	NA	78.5		
Total Number of Species	NA	37		
Total Number of Hybrid Species	NA	1		
IBI	42			
1 st Pass		50		
2 nd Pass		48		
MIwb	8.7			
1 st Pass		10.2		
2 nd Pass		9.6		
ICI	38	54		

TABLE 4.3.34: (continued)
Scioto-Little Walnut Confluence Surface Waters Area – Commercial Point Road Zone
Metering and Sampling Data Summary

Bacteria			
Measure	WQS¹	Minimum	Maximum
Fecal Coliform			
<i>Dry Weather</i>		120	570
<i>Wet Weather</i>	1000	170	160,000
E. coli			
<i>Dry Weather</i>		110	280
<i>Wet Weather</i>	126	100	94,000

¹ 30-day geometric mean values in the current Ohio WQS

Table 4.3.35 Annual Hours Exceeding Maximum Criterion for Bacteria WQS ES2005													
		System A											
		12 - John Herrick		31 - Downtown		39 - Greenlawn		44 - SR104		53 - I-270		59 - SR665	
		E.coli	Fecals	E.coli	Fecals	E.coli	Fecals	E.coli	Fecals	E.coli	Fecals	E.coli	Fecals
ES2005	January	154	149	170	155	232	51	313	157	411	307	401	296
	February	239	235	302	221	312	189	317	206	546	218	532	207
	March	122	119	164	117	167	49	188	89	220	106	219	101
	April	198	193	268	194	276	77	296	107	290	162	292	155
	May	347	342	424	313	440	158	441	156	439	175	430	157
	June	259	254	316	172	333	120	338	135	345	179	339	174
	July	129	125	151	135	192	91	210	115	223	167	222	173
	August	72	67	88	69	123	37	146	68	126	82	137	93
	September	116	113	144	114	144	40	150	54	149	50	142	38
	October	47	42	72	60	103	17	123	44	123	54	131	63
	November	108	106	125	99	168	48	176	83	175	108	176	105
	December	211	205	221	197	251	60	280	161	452	259	445	253
	Bathing Season												
	Total Hours:	969	942	1195	864	1335	463	1408	573	1406	708	1401	700
		System B				System C							
		18 - AC @ 104		57 - Rowe		7 - SR762		20 - SR316		31 - Commercial Point			
		E.coli	Fecals	E.coli	Fecals	E.coli	Fecals	E.coli	Fecals	E.coli	Fecals		
ES2005	January	237	221	295	150	376	241	362	224	349	179		
	February	337	324	360	182	504	198	482	166	448	136		
	March	200	188	285	110	211	94	209	91	223	91		
	April	211	198	241	181	283	136	273	131	266	136		
	May	148	140	183	123	410	142	403	129	394	133		
	June	157	147	198	124	328	162	323	158	319	156		
	July	188	182	204	165	215	163	215	162	209	173		
	August	125	113	162	82	150	83	137	81	139	87		
	September	63	56	85	28	126	28	121	26	106	25		
	October	84	71	123	70	103	57	103	59	137	53		
	November	108	102	137	110	167	96	161	91	168	95		
	December	280	264	311	204	407	231	384	216	349	203		
	Bathing Season												
	Total Hours:	765	710	954	592	1332	634	1302	615	1304	628		

Notes:

(1) Based on annual water quality model simulations for the LTCP typical year

(2) Shaded months represent Recreational Season

TABLE 4.3.36 Dry Weather Sampling Days and Antecedent Dry Days	
Dry Weather Sampling Day	Antecedent Dry Days
October 25, 2003	7
July 1, 2004	6
August 8, 2004	3
August 17, 2004	12
September 7, 2004	7

TABLE 4.3.37
Dry Weather Conditions
October and November 2003 and April 2004 through October 2004
Ohio WQS Summary of Observed Exceedances or Concerns

Surface Water Area/Zone	Observations
Upper Olentangy <i>Wilson Bridge Road</i>	
Chemistry – Water Column	Maximum Temperature in May 13, 2004 between 4:45 p.m. and 10:00 p.m. and on May 14, 2004 between 6:15 p.m. and 7:00 p.m.
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	August 8, August 17 and September 7, 2004
<i>State Route 161</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	July 1, August 8, August 17 and September 7, 2004
<i>Henderson Road</i>	
Chemistry – Water Column	DO less than 4 mg/l on August 12, 2004 between 4:30 a.m. and 4:45 a.m.
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	August 17, 2004
Lower Olentangy <i>Dodridge Street</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	July 1, August 8 and August 17, 2004
Toxicity	None
<i>John Herrick Drive</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	July 1, August 17 and September 7, 2004
<i>Fifth Avenue</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	July 1 and August 17, 2004

TABLE 4.3.37: (continued)
Dry Weather Conditions
October and November 2003 and April 2004 through October 2004
Ohio WQS Summary of Observed Exceedances or Concerns

Surface Water Area/Zone	Observations
Lower Olentangy (cont'd)	
<i>Goodale Avenue</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	July 1, 2004
Scioto-Downtown	
<i>State Route 33 (Olentangy River)</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	All five dry weather sampling days in Exhibit 4.3.2.1
<i>Souder Avenue (Scioto River)</i>	
Chemistry – Water Column	DO was less than 4 mg/l on September 14, 2004 between 5:15 a.m. and 10:46 a.m.
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	None
<i>Broad Street</i>	
Chemistry – Water Column	DO less than 3 mg/l on August 18, 2004 between 1:30 a.m. and 2:46 a.m.
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	None
<i>Town Street</i>	
Chemistry – Water Column	DO less than 3 mg/l on August 18, 2004 between 7:15 a.m. and 10:15 a.m., 12:30 p.m. and 3:01 p.m. and 4:16 p.m. and 4:46 p.m.
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	None
Toxicity	None

TABLE 4.3.37: (continued) Dry Weather Conditions October and November 2003 and April 2004 through October 2004 Ohio WQS Summary of Observed Exceedances or Concerns	
Surface Water Area/Zone	Observations
Scioto-Downtown (cont'd)	
<i>Main Street</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	None
<i>I-70</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	None
<i>Greenlawn Avenue</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	None
Scioto-South Columbus	
<i>State Route 104</i>	
Chemistry – Water Column	DO less than 4 mg/l on August 13, 2004 at 8:00 a.m. and at 12:31 p.m. and on August 14, 2004 between 12:45 a.m. and 11:00 a.m.
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	August 8, 2004 and August 17, 2004
<i>Jackson Pike</i>	
Chemistry – Water Column	DO less than 4 mg/l on August 14, 2004 between 5:01 a.m. and 8:01 a.m.
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	None
<i>I 270</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	August 8 and August 17, 2004
E. coli (30-day)	All five dry weather sampling days in Exhibit 4.3.2.1

TABLE 4.3.37: (continued) Dry Weather Conditions October and November 2003 and April 2004 through October 2004 Ohio WQS Summary of Observed Exceedances or Concerns	
Surface Water Area/Zone	Observations
Upper Alum Creek <i>Cleveland Avenue</i> Chemistry – Water Column Biology Fecal Coliform (30-day) E. coli (30-day)	None None August 17, 2004 July 1, August 8, August 17 and September 7, 2004
<i>State Route 3</i> Chemistry – Water Column Biology Fecal Coliform (30-day) E. coli (30-day)	None None None August 8, 2004 and on August 17, 2004
<i>Mock Road</i> Chemistry – Water Column Biology Fecal Coliform (30-day) E. coli (30-day)	None None None None
Lower Alum Creek <i>Main Street</i> Chemistry – Water Column Biology Fecal Coliform (30-day) E. coli (30-day) Toxicity	None IBI below 42 August 8, 2004 July 1, August 8 and August 17, 2004 None
<i>Livingston Avenue</i> Chemistry – Water Column Biology Fecal Coliform (30-day) E. coli (30-day) Toxicity	None IBI below 42 August 8, 2004 July 1, August 8 and August 17, 2004 None
Three Rivers <i>State Route 104 (Alum Creek)</i> Chemistry – Water Column Biology Fecal Coliform (30-day) E. coli (30-day)	None IBI below 42 None None

TABLE 4.3.37: (continued) Dry Weather Conditions October and November 2003 and April 2004 through October 2004 Ohio WQS Summary of Observed Exceedances or Concerns	
Surface Water Area/Zone	Observations
Three Rivers (cont'd)	
<i>Williams Road (Alum Creek)</i>	
Chemistry – Water Column	None
Biology	IBI below 42
Fecal Coliform (30-day)	None
E. coli (30-day)	None
<i>Winchester Pike (Blacklick Creek)</i>	
Chemistry – Water Column	None
Biology	Miwb was less than 8.5
Fecal Coliform (30-day)	None
E. coli (30-day)	July 1, August 8 and August 17, 2004
<i>Williams Road (Big Walnut Creek)</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	October 23, 2003 and September 7, 2004
<i>Reese Road (Big Walnut Creek)</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	August 17, 2004
Scioto-Big Walnut Confluence	
<i>Rowe Road (Big Walnut Creek)</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	None
<i>State Route 665 (Scioto River)</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	All five dry weather sampling days in Exhibit 4.3.2.1
E. coli (30-day)	All five dry weather sampling days in Exhibit 4.3.2.1

TABLE 4.3.37 (continued)
Dry Weather Conditions
October and November 2003 and April 2004 through October 2004
Ohio WQS Summary of Observed Exceedances or Concerns

Surface Water Area/Zone	Observations
Scioto-Little Walnut Confluence	
<i>State Route 762 (Scioto River)</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	August 18 and September 7, 2004
E. coli (30-day)	All five dry weather sampling days in Exhibit 4.3.2.1
 <i>State Route 316</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	None
E. coli (30-day)	August 8, 2004
 <i>Commercial Point Road</i>	
Chemistry – Water Column	None
Biology	None
Fecal Coliform (30-day)	August 8, 2004
E. coli (30-day)	None

TABLE 4.3.38:
Dry Weather Conditions
October and November 2003 and April 2004 through October 2004
Sediment Chemistry and QHEI Values

Surface Water Area and Zone	Observed Guideline Values Exceedance
Upper Olentangy <i>Wilson Bridge Road</i> Chemistry - Sediment QHEI <i>State Route 161</i> Chemistry - Sediment <i>Henderson Road</i> Chemistry - Sediment	Rare possibility of adverse biological effects Nickel ~ 4% higher Threshold Effect Concentration (TEC) concentration Other six metals less than TECs 77.0 is within the WWH 60 to 88 fish assemblage range Rare possibility of adverse biological effects All seven metals less than TECs guideline concentrations Rare possibility of adverse biological effects All seven metals less than TEC guideline concentrations
Lower Olentangy <i>Dodridge Street</i> Chemistry - Sediment <i>John Herrick Drive</i> Chemistry - Sediment	Low probability of adverse biological effects Copper ~ 33% higher than TEC guideline concentration Lead ~ 140% higher than TEC guideline concentration Nickel ~ 24% higher than TEC guideline concentration Zinc ~ 33% higher than TEC guideline concentration All three other metals less than TEC guideline concentrations Low probability of adverse biological effect Copper ~ 26% higher than TEC guideline concentration Lead ~ 11% higher than TEC guideline concentration Nickel ~ 6% higher than TEC guideline concentration Zinc ~ 2% higher than TEC guideline concentration All four other metals less than TEC guideline concentrations

TABLE 4.3.38: (continued) Dry Weather Conditions October and November 2003 and April 2004 through October 2004 Sediment Chemistry and QHEI Values	
Surface Water Area and Zone	Observed Guideline Values Exceedance
Lower Olentangy (cont'd) <i>Fifth Avenue</i> Chemistry - Sediment QHEI <i>Goodale Avenue</i> Chemistry - Sediment	Some probability of adverse biological effect Cadmium ~ 5% higher than TEC guideline concentration Lead ~ 191% higher than PEC guideline concentration Mercury ~ 83% higher than TEC guideline concentration All four other metals less than TEC guideline concentrations 34.5 is below the MWH (Impounded) 56 to 71 fish assemblage range Rare probability of adverse biological effect Lead ~ 94% higher than TEC guideline concentration All other six metals less than TEC guideline concentrations
Scioto-Downtown <i>State Route 33 (Olentangy River)</i> Chemistry - Sediment QHEI <i>Souder Avenue (Scioto River)</i> Chemistry - Sediment	Rare probability of adverse biological effect Other seven metals less than TEC guideline concentrations 48.5 is below the MWH (Impounded) 56 to 71 fish assemblage range 60 to 88 Low probability of adverse biological effect Lead ~ 78% higher than TEC guideline concentration Mercury ~ 83% higher than TEC guideline concentration All four other metals less than TEC guideline concentrations

TABLE 4.3.38: (continued) Dry Weather Conditions October and November 2003 and April 2004 through October 2004 Sediment Chemistry and QHEI Values	
Surface Water Area and Zone	Observed Guideline Values Exceedance
Scioto-Downtown (cont'd) <i>Broad Street</i> Chemistry - Sediment <i>Town Street</i> Chemistry - Sediment <i>Main Street</i> Chemistry - Sediment <i>I-70</i> QHEI	<p>Low probability of adverse biological effect Cadmium ~ 7% higher than TEC guideline concentration</p> <p>Copper ~ 53% higher than TEC guideline concentration Lead ~ 146% higher than TEC guideline concentration Zinc ~ 3% higher than TEC guideline concentration All three other metals less than TEC guideline concentrations</p> <p>Low probability of adverse biological effect Cadmium ~ 7% higher than TEC guideline concentration</p> <p>Copper ~ 95% higher than TEC guideline concentration Lead ~ 143% higher than TEC guideline concentration Nickel ~ 16% higher than TEC guideline concentration Zinc ~ 28% higher than TEC guideline concentration All three other metals less than TEC guideline concentrations</p> <p>Some probability of adverse biological effect Cadmium ~ 3% higher than TEC guideline concentration</p> <p>Copper ~ 64% higher than TEC guideline concentration Lead ~ 42% higher than PEC guideline concentration Nickel ~ 3% higher than TEC guideline concentration Zinc ~ 156% higher than TEC guideline concentration All three other metals less than TEC guideline concentrations</p> <p>72.0 is slightly higher than the MWH (Impounded) 56 to 71 fish assemblage range</p>

TABLE 4.3.38: (continued) Dry Weather Conditions October and November 2003 and April 2004 through October 2004 Sediment Chemistry and QHEI Values	
Surface Water Area and Zone	Observed Guideline Values Exceedance
Scioto-Downtown (cont'd) <i>Greenlawn Avenue</i> Chemistry - Sediment QHEI Scioto-South Columbus <i>State Route 104</i> Chemistry - Sediment <i>I 270</i> Chemistry - Sediment Upper Alum Creek <i>Cleveland Avenue</i> Chemistry - Sediment QHEI	<p>Low probability of adverse biological effect Lead ~ 38% higher than TEC guideline concentration Mercury ~ 83% higher than TEC guideline concentration All five other metals less than TEC guideline concentrations</p> <p>72.0 is slightly higher than the MWH (Impounded) 56 to 71 fish assemblage range</p> <p>Low probability of adverse biological effect Cadmium ~ 2% higher than TEC guideline concentration Copper ~ 16% higher than TEC guideline concentration Lead ~ 164% higher than TEC guideline concentration Mercury ~ 83% higher than TEC guideline concentration All three other metals less than TEC guideline concentrations</p> <p>Low probability of adverse biological effect Lead ~ 58% higher than TEC guideline concentration Mercury ~ 14% higher than TEC guideline concentration All five other metals less than TEC guideline concentrations</p> <p>Low probability of adverse biological effect Copper ~ 66% higher than TEC guideline concentration Nickel ~ 97% higher than TEC guideline concentration Zinc ~ 13% higher than TEC guideline concentration All four other metals less than TEC guideline concentrations</p> <p>75.0 is within the WWH 60 to 88 fish assemblage range</p>

TABLE 4.3.38: (continued) Dry Weather Conditions October and November 2003 and April 2004 through October 2004 Sediment Chemistry and QHEI Values	
Surface Water Area and Zone	Observed Guideline Values Exceedance
Upper Alum Creek (cont'd) <i>State Route 3</i>	
Chemistry - Sediment	Low probability of adverse biological effect Mercury ~ 83% higher than TEC guideline concentration Nickel ~ 63% higher than TEC guideline concentration Zinc ~ 23% higher than TEC guideline concentration All four other metals less than TEC guideline concentrations
<i>Mock Road</i>	
Chemistry - Sediment	Rare probability of adverse biological effect Nickel ~ 7% higher than TEC guideline concentration All six other metals less than TEC guideline concentrations
QHEI	76.5 is within the WWH 60 to 88 fish assemblage range
Lower Alum Creek <i>Main Street</i>	
Chemistry - Sediment	Low probability of adverse biological effect Lead ~ 25% higher than TEC guideline concentration Zinc ~ 8% higher than TEC guideline concentration All five other metals less than TEC guideline concentrations
QHEI	65.0 is within the WWH 60 to 88 fish assemblage range
<i>Livingston Avenue</i>	
Chemistry - Sediment	Low probability of adverse biological effect Lead ~ 2% higher than TEC guideline concentration Zinc ~ 8% higher than TEC guideline concentration All five other metals less than TEC guideline concentrations

TABLE 4.3.38: (continued)
Dry Weather Conditions
October and November 2003 and April 2004 through October 2004
Sediment Chemistry and QHEI Values

Surface Water Area and Zone	Observed Guideline Values Exceedance
Three Rivers <i>State Route 104 (Alum Creek)</i> Chemistry - Sediment	Some probability of adverse biological effect Cadmium ~ 10% higher than TEC guideline concentration Copper ~ 21% higher than TEC guideline concentration Lead ~ 96% higher than TEC guideline concentration Nickel ~ 12% higher than TEC guideline concentration Zinc ~ 21% higher than TEC guideline concentration The two other metals less than TEC guideline concentrations
<i>Williams Road (Alum Creek)</i> Chemistry - Sediment	Some probability of adverse biological effect Copper ~ 50% higher than TEC guideline concentration Lead ~ 68% higher than TEC guideline concentration Mercury ~ 167% higher than TEC guideline concentration Nickel ~ 32% higher than TEC guideline concentration Zinc ~ 6% higher than TEC guideline concentration The two other metals less than TEC guideline concentrations
QHEI	70.5 is within the WWH 60 to 88 fish assemblage range
<i>Winchester Pike (Blacklick Creek)</i> Chemistry - Sediment	Rare probability of adverse biological effect Other seven metals less than TEC guideline concentrations
QHEI	83.5 is within the WWH 60 to 88 fish assemblage range

TABLE 4.3.38: (continued)
Dry Weather Conditions
October and November 2003 and April 2004 through October 2004
Sediment Chemistry and QHEI Values

Surface Water Area and Zone	Observed Guideline Values Exceedance
Three Rivers (cont'd) <i>Williams Road (Big Walnut Creek)</i> Chemistry - Sediment QHEI <i>Reese Road (Big Walnut Creek)</i> Chemistry - Sediment QHEI Scioto-Big Walnut Confluence <i>Rowe Road (Big Walnut Creek)/</i> Chemistry - Sediment QHEI <i>State Route 665 (Scioto River)</i> Chemistry - Sediment QHEI	<p>Low probability of adverse biological effect Cadmium ~ 57% higher than TEC guideline concentration Nickel ~ 14% higher than TEC guideline concentration Zinc at the TEC guideline concentration All four other metals less than TEC guideline concentrations</p> <p>88.5 is slightly higher than the WWH 60 to 88 fish assemblage range</p> <p>Low probability of adverse biological effect Cadmium ~ 13% higher than TEC guideline concentration Mercury ~ 83% higher than TEC guideline concentration All five other metals less than TEC guideline concentrations</p> <p>83.0 is within the WWH 60 to 88 fish assemblage range</p> <p>Rare probability of adverse biological effect All other seven metals less than TEC guideline concentrations</p> <p>91.5 is higher than the WWH 60 to 88 fish assemblage range</p> <p>Rare probability of adverse biological effect All other seven metals less than TEC guideline concentrations</p> <p>82.5 is within the WWH 60 to 88 fish assemblage range</p>

TABLE 4.3.38: (continued) Dry Weather Conditions October and November 2003 and April 2004 through October 2004 Sediment Chemistry and QHEI Values	
Surface Water Area and Zone	Observed Guideline Values Exceedance
Scioto-Big Walnut Confluence (cont'd) <i>State Route 762 (Scioto River)</i> Chemistry - Sediment	Rare probability of adverse biological effect All other seven metals less than TEC guideline concentrations
Scioto-Little Walnut Confluence <i>State Route 316</i> Chemistry - Sediment	Rare probability of adverse biological effect All other seven metals less than TEC guideline concentrations
 QHEI	76.0 is within the WWH 60 to 88 fish assemblage range
 <i>Commercial Point Road</i> Chemistry - Sediment	Rare probability of adverse biological effect All other seven metals less than TEC guideline concentrations
 QHEI	78.5 is within the WWH 60 to 88 fish assemblage range

TABLE 4.3.39: Wet Weather Sampling Events and Antecedent Dry Days	
Wet Weather Sampling Event	Antecedent Dry Days
October 14-17, 2003	9
April 30 - May 3, 2004	3
July 11 - 14, 2004	3
July 30 – August 2, 2004	3
September 8 - 11, 2004	7
October 18 - 21, 2004	2

TABLE 4.3.40: Wet Weather Sampling Days and Antecedent Dry Days	
Wet Weather Sampling Day	Antecedent Dry Days
October 15, 2004	1
November 2, 2004	5
November 11, 2004	6

TABLE 4.3.41:
Wet Weather Conditions
October and November 2003 and April 2004 through October 2004
Ohio WQS Summary of Observed Exceedences or Concerns

Surface Water Area and Zone	Observations
Upper Olentangy <i>Wilson Bridge Road</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1
<i>State Route 161</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1
<i>Henderson Road</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1
Lower Olentangy <i>Dodridge Street</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) Toxicity	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 None
<i>John Herrick Drive</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1
<i>Fifth Avenue</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1
<i>Goodale Avenue</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1

TABLE 4.3.41: (continued) Wet Weather Conditions October and November 2003 and April 2004 through October 2004 Ohio WQS Summary of Observed Exceedences or Concerns	
Surface Water Area and Zone	Observations
Scioto-Downtown <i>State Route 33 (Olentangy River)</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) <i>Souder Avenue (Scioto River)</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) <i>Broad Street</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) <i>Town Street</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) Toxicity <i>Main Street</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) <i>I-70</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) <i>Greenlawn Avenue</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	DO less than 3 mg/l on August 28, 2004 between 6:00 a.m. and 10:30 a.m. All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 DO less than 3 mg/l on August 19, 2004 between 5:30 a.m. and 6:00 a.m. and 20, 2004 and on August 20, 2004 between 7:15 a.m. and 10:45 a.m. All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 DO less than 3.0 mg/l on August 20, 2004 between 8:46 a.m. and 5:30 p.m. All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 None None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1

TABLE 4.3.41: (continued) Wet Weather Conditions October and November 2003 and April 2004 through October 2004 Ohio WQS Summary of Observed Exceedences or Concerns	
Surface Water Area and Zone	Observations
Scioto-South Columbus <i>State Route 104</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) Toxicity <i>Jackson Pike</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) Toxicity <i>I 270</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) Upper Alum Creek <i>Cleveland Avenue</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) <i>State Route 3</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) <i>Mock Road</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 None DO was less than 4 mg/l between July 11, 2004 at 9:46 a.m. and July 12, 2004 at 2:16 p.m., on July 13, 2004 between 12:15 a.m. and 12:00 p.m., on July 14, 2004 between 1:00 a.m. and 12:00 p.m. and on September 8, 2004 between 10:00 a.m. and 1:15 p.m. All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 None None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 Copper on September 7, 2004 and September 9, 2004 All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1

TABLE 4.3.41: (continued) Wet Weather Conditions October and November 2003 and April 2004 through October 2004 Ohio WQS Summary of Observed Exceedences or Concerns	
Surface Water Area and Zone	Observations
Lower Alum Creek <i>Main Street</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) Toxicity <i>Livingston Avenue</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) Toxicity Three Rivers <i>State Route 104 (Alum Creek)</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) <i>Williams Road (Alum Creek)</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) <i>Winchester Pike (Blacklick Creek)</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) <i>Williams Road (Big Walnut Creek)</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day) <i>Reese Road (Big Walnut Creek)</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 None None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 None None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 DO was less than 4 mg/l on September 8, 2004 between 6:01 a.m. and 9:31 a.m. All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1 DO was less than 5 mg/l on July 12, 2004 between 4:00 a.m. and 9:16 a.m. All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1

TABLE 4.3.41: (continued) Wet Weather Conditions October and November 2003 and April 2004 through October 2004 Ohio WQS Summary of Observed Exceedences or Concerns	
Surface Water Area and Zone	Observations
Scioto-Big Walnut Confluence <i>Rowe Road (Big Walnut Creek)</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1
<i>State Route 665 (Scioto River)</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1
<i>State Route 762 (Scioto River)</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1
Scioto-Little Walnut Confluence <i>State Route 316</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1
<i>Commercial Point Road</i> Chemistry – Water Column Fecal Coliform (30-day) E. coli (30-day)	None All six wet weather sampling days in Exhibit 4.3.2.1 All six wet weather sampling days in Exhibit 4.3.2.1

**TABLE 4.3.42:
CSS Activations during 2003 – 2004 Wet Weather Sampling**

October 14-17, 2003			
CSS Discharge	Overflow Initiation	Overflow Termination	Overflow Volume (MG)
Kerr & Russell	10/14 12:20	10/14 16:30	<0.1
Cherry & Fourth	10/14 12:30	10/14 16:00	0.1
Mound & Grant	10/14 12:50	10/14 16:10	<0.1
Noble & Grant	10/14 13:25	10/14 13:40	<0.1
Whittier Street Storm Standby Tanks	10/14 14:25	10/14 17:30	9.3
April 30-May 3, 2004			
CSS Discharge	Overflow Initiation	Overflow Termination	Overflow Volume (MG)
Cherry & Fourth	4/30 11:25	4/30 12:55	0.1
Kerr & Russell	4/30 11:20	4/30 14:20	<0.1
Mound & Grant	4/30 11:15	4/30 13:45	<0.1
Noble & Grant	4/30 11:40	4/30 11:50	<0.1
Town & Fourth	4/30 11:25	4/30 12:45	<0.1
Cherry & Fourth	5/1 21:00	5/2 11:15	0.1
Kerr & Russell	5/1 20:55	5/2 8:20	<0.1
Town & Fourth	5/1 21:00	5/2 8:30	<0.1
Mound & Grant	5/1 20:55	5/2 12:40	<0.1
Noble & Grant	5/2 0:55	5/2 3:05	<0.1
Whittier Street Storm Standby Tanks	5/2 3:15	5/3 14:10	104.9
July 11-14, 2004			
CSOS Discharge	Overflow Initiation	Overflow Termination	Overflow Volume (MG)
Broad Street	7/11 16:55	7/11 17:15	0.3
Chestnut Street	7/11 16:40	7/11 17:25	2.8
Cherry & Fourth	7/11 15:10	7/11 15:40	0.1
First Avenue	7/11 17:05	7/11 17:45	0.1
Frambes Avenue	7/11 17:00	7/11 17:05	0.0
Henry Street	7/11 16:40	7/11 17:15	3.2
Hudson Street	7/11 17:00	7/11 17:05	0.0
Indianola Avenue	7/11 16:50	7/11 17:25	2.0
Kerr & Russell	7/11 16:30	7/11 17:25	0.2
King Avenue	7/11 16:45	7/11 17:25	0.1
Long Street	7/11 16:30	7/11 17:00	0.2
Markinson Avenue	7/11 17:00	7/11 17:40	1.1
Moler Street	7/11 16:55	7/11 17:40	2.2
Mound Street east of I-71	7/11 16:55	7/11 17:25	0.0

TABLE 4.3.42: (continued)
CSS Activations during 2003 – 2004 Wet Weather Sampling

July 11-14, 2004 (cont'd)			
CSS Discharge	Overflow Initiation	Overflow Termination	Overflow Volume (MG)
Noble & Fourth	7/11 16:40	7/11 17:05	<0.1
Noble & Grant	7/11 15:10	7/11 21:00	<0.1
Liberty Street (Peters Run)	7/11 16:50	7/11 17:30	7.3
Third Avenue	7/11 16:45	7/11 17:35	2.0
Town & Fourth	7/11 15:15	7/11 17:25	0.3
Whittier Street	7/11 17:00	7/11 17:50	4.6
Whittier Street Storm Standby Tanks	7/11 17:05	7/11 21:00	12.1
Alum Creek Storm Standby Tank	7/11		0.6
July 30-August 2, 2004			
CSS Discharge	Overflow Initiation	Overflow Termination	Overflow Volume (MG)
Cherry & Fourth	7/30 19:20	7/31 7:10	0.4
Kerr & Russell	7/31 0:50	7/31 6:50	0.2
Noble & Grant	7/31 0:50	7/31 23:35	0.1
Broad Street	7/31 16:10	7/31 16:30	0.4
Chestnut Street	7/31 3:35	7/31 4:00	0.6
Chestnut Street	7/31 16:05	7/31 16:50	2.7
Cherry & Fourth	7/31 15:55	7/31 17:40	<0.1
First Avenue	7/31 1:30	7/31 1:35	0.0
First Avenue	7/31 16:15	7/31 16:45	0.1
Henry Street	7/31 1:25	7/31 1:35	0.1
Henry Street	7/31 16:05	7/31 16:40	3.2
Indianola Avenue	7/31 1:15	7/31 1:35	0.6
Indianola Avenue	7/31 16:10	7/31 16:15	0.0
Kerr & Russell	7/31 15:50	7/31 16:45	0.2
King Avenue	7/31 1:25	7/31 1:35	0.0
King Avenue	7/31 16:15	7/31 16:25	0.0
Long Street	7/31 16:05	7/31 16:30	0.4
Mound & Grant	7/31 3:25	7/31 4:10	<0.1
Markinson Avenue	7/31 3:30	7/31 4:00	1.0
Markinson Avenue	7/31 16:30	7/31 17:15	2.4
Moler Street	7/31 3:30	7/31 4:00	1.1
Moler Street	7/31 16:15	7/31 17:15	3.9
Liberty Street (Peters Run)	7/31 3:30	7/31 3:45	1.7
Liberty Street (Peters Run)	7/31 16:15	7/31 16:50	6.7
State Street	7/31 16:10	7/31 16:20	<0.1
Third Avenue	7/31 1:15	7/31 1:35	0.2
Third Avenue	7/31 16:00	7/31 16:20	0.1
Town & Fourth	7/31 0:50	7/31 6:40	0.2

TABLE 4.3.42: (continued)			
CSS Activations during 2003 – 2004 Wet Weather Sampling			
July 30-August 2, 2004 (cont'd)			
CSS Discharge	Overflow Initiation	Overflow Termination	Overflow Volume (MG)
Town & Fourth	7/31 15:55	7/31 19:30	<0.1
Whittier Street	7/31 1:35	7/31 4:10	2.1
Whittier Street	7/31 16:15	7/31 17:25	6.5
Whittier Street Storm Standby Tanks	7/31 1:40	7/31 16:30	208
Alum Creek Storm Standby Tank	7/31		2.6
September 8-11, 2004			
CSS Discharge	Overflow Initiation	Overflow Termination	Overflow Volume (MG)
Cherry & Fourth	9/8 0:20	9/8 0:55	<0.1
Noble & Grant	9/8 0:20	9/8 1:30	<0.1
Noble & Fourth	9/8 0:20	9/8 0:25	<0.1
Town & Fourth	9/8 0:25	9/8 0:45	<0.1
Mound & Grant	9/8 0:25	9/8 5:00	<0.1
Kerr & Russell	9/8 0:30	9/8 1:10	<0.1
Noble & Grant	9/8 8:20	9/8 11:15	<0.1
Cherry & Fourth	9/8 10:30	9/8 17:20	<0.1
Town & Fourth	9/8 11:05	9/8 14:25	<0.1
Whittier Street Storm Standby Tanks	9/8 0:45	9/8 0:50	23.6
October 18-21, 2004			
CSS Discharge	Overflow Initiation	Overflow Termination	Overflow Volume (MG)
Cherry & Fourth	10/18 12:00	10/18 19:15	0.4
Chestnut Street	10/18 18:55	10/18 19:15	0.7
Kerr & Russell	10/18 12:15	10/18 19:20	<0.1
Long Street	10/18 18:45	10/18 18:55	<0.1
Markinson Avenue	10/18 18:15	10/18 19:10	0.6
Moler Street	10/18 18:05	10/18 19:15	1.2
Mound Street east of I-71	10/18 18:55	10/18 19:00	<0.1
Noble & Fourth	10/18 18:45	10/18 18:55	<0.1
Noble & Grant	10/18 11:20	10/21 23:55	0.2
Liberty Street (Peters Run)	10/18 18:45	10/18 19:10	6.1
Town & Fourth	10/18 12:05	10/18 19:25	0.4
Whittier Street	10/18 13:20	10/18 19:25	4.4
Whittier Street Storm Standby Tanks	10/18 13:10	10/19 9:05	76.3

TABLE 4.3.43: Southerly Bypass Discharges during 2003 – 2004 Wet Weather Sampling			
April 30-May 3, 2004			
	Overflow Initiation	Overflow Termination	Overflow Volume (MG)
SWWTP Bypass	5/2		14.2
SWWTP Bypass	5/3		0.1
July 30-August 2, 2004			
	Overflow Initiation	Overflow Termination	Overflow Volume (MG)
SWWTP Bypass	7/31		24.6
SWWTP Bypass	8/1		4.0

TABLE 4.3.44:
Comparison of 2003 – 2004 Wet Weather Sampling Activations and Volumes
With
Activations and Volumes predicted by the 2005 Existing System (2005 ES) SWMM for the
Typical Year Precipitation Pattern

Discharge Point	2003 – 2004 Metering and Sampling Events		2 nd , 3 rd and 4 th quarters predicted by the 2005 ES SWMM	
	Volume (MG)	# of Activations	Volume (MG)	# of Activations
Markison Avenue	5.1	4	10.73	19
Moler Street	8.4	4	10.15	22
Whittier Street	17.8	4	69.83	24
Liberty Street (Peters Run)	21.8	4	12.31	13
Dodge Park	-	0	0.36	3
Rich Street	-	0	-	0
Town Street	-	0	-	0
State Street	0.0	1	0.01	4
Capital Street	-	0	0.0	1
Broad Street	0.7	2	1.15	3
Long Street	0.6	3	1.67	5
Spring Street	-	0	0.53	5
Kerr & Russell Streets	0.3	8	-	0
Chestnut Street	6.8	4	20.29	7
Henry Street	6.5	3	15.56	9
First Avenue	0.2	3	0.29	6
Third Avenue	2.3	3	11.04	5
King Avenue	0.1	3	1.32	6
Indianola Avenue	2.6	3	6.13	6
Frambes Avenue	0.0	1	2.9	3
Doe Alley	-	0	0.73	3
Hudson Street	0.0	1	0.25	1
Whittier Street Storm Standby Tanks	443.2	6	691.8	23
Alum Creek Storm Tank	3.2	2	10.89	6
SWWTP Bypass	42.9	4	196.63	16

TABLE 4.3.45:
Percentage of Activations and Volumes predicted by the 2005 Existing System (2005 ES)
SWMM for the Typical Year Precipitation Pattern
Measured during the 2003 – 2004 Wet Weather Sampling Activations and Volumes

Discharge Point	% of Predicted Volume Sampled	% of Predicted Activations Sampled
Markison Avenue	48	21
Moler Street	83	18
Whittier Street	25	17
Liberty Street (Peters Run)	177	31
Dodge Park	0	0
Rich Street	100	100
Town Street	100	100
State Street	0	0
Capital Street	100	100
Broad Street	61	67
Long Street	36	60
Spring Street	0	0
Kerr & Russell Streets	33	57
Chestnut Street	34	57
Henry Street	42	33
First Avenue	69	50
Third Avenue	21	60
King Avenue	8	50
Indianola Avenue	42	50
Frambes Avenue	0	33
Doe Alley	0	0
Hudson Street	0	100
Whittier Street Storm Standby Tanks	64	26
Alum Creek Storm Tank	29	33
SWWTP Bypass	22	25

**TABLE 4.3.46:
Possible SSOs during September 8 – 11, 2004 Wet Weather Sampling Event**

Possible SSO Discharge	Receiving Water
MH - Third Ave., 290 ft. w/o Olentangy River Rd.	Olentangy River @ Third Avenue
MH - Third Ave. & Oxley (west)	Olentangy River @ Third Avenue
MH - 814 W. Third Ave.	Olentangy River @ Third Avenue
MH - Third & Morning	Olentangy River @ Third Avenue
MH - Hamilton & alley n/o Duxberry	Olentangy River @ Woody Hayes Drive
MH - Lakeview & alley w/o Cleveland Ave.	Alum Creek U/S of Mock Road
MH - Aberdeen & Parkwood	Alum Creek U/S of Mock Road
MH - alley e/o High & s/o Schreyer Pl.	Olentangy River @ Adena Brook
MH - Plum Ridge n/o Lornaberry	Big Walnut Creek U/S of Main Street

**TABLE 4.3.47:
Designated Special Water Qualities**

Alum Creek			
Special Water Quality	Upstream River Mile	Downstream River Mile	Impacting CSS Discharge
Alum Creek does not currently have any special water qualities designations in the area where a CSS discharge could impair attainment of those special water qualities			
Big Walnut Creek			
Special Water Quality	Upstream River Mile	Downstream River Mile	Impacting CSS Discharge
<i>Superior High Quality Water</i>	28.2	0.0	Alum Creek Storm Tank
Olentangy River			
Special Water Quality	Upstream River Mile	Downstream River Mile	Impacting CSS Discharge
The Olentangy River does not currently have any special water qualities designations in the area where a CSS discharge could impair attainment of those special water qualities			
Scioto River			
Special Water Quality	Upstream River Mile	Downstream River Mile	Impacting CSS Discharge
<i>Superior High Quality Water</i>	145.18	132.22	None
<i>State Resource Water - General High Quality Water</i>	132.4	126.97	All Lower Olentangy, Scioto-Downtown and Scioto-South Columbus CSS discharges

TABLE 4.3.48: Publicly Owned Areas with Immediate Access to Alum Creek and Big Walnut Creek			
Identified Sensitive Area	Area River Mile Boundary	CSS River Mile Location	Impacting CSS Discharge(s)
Three Creeks Park and Alum Creek Greenway – Alum Creek <i>Upstream Boundary</i> <i>Downstream Boundary</i>	3.99 0.00	6.92	Alum Creek Storm Standby Tank
Three Creeks Park – Big Walnut <i>Upstream Boundary</i> <i>Downstream Boundary</i>	15.14 13.08		

**TABLE 4.3.49:
Publicly Owned Areas with Immediate Access to Olentangy River and Scioto River**

Identified Sensitive Area	CSS River Mile Location	CSS River Mile Location	Impacting CSS Discharge(s)
Olentangy River Greenway <i>Upstream Boundary</i>	15.14		
Ohio State University <i>Upstream Boundary</i>	3.93		
Tuttle Park <i>Upstream Boundary</i>	3.87		
<i>Downstream Boundary</i>	3.31	3.78	Hudson Street
		3.08	Doe Alley
		3.08	Frambes Avenue
		2.47	Indianola Avenue
Ohio State University <i>Downstream Boundary</i>	1.89	1.89	King Avenue
		1.49	Third Avenue
		1.25	First Avenue
Olentangy River Greenway <i>Downstream Boundary</i>	0.5		
North Bank Riverfront Park <i>Upstream Boundary</i>	131.25		
<i>Downstream Boundary</i>	131.05	131.19	Henry Street
Battelle Riverfront Park <i>Upstream Boundary</i>	130.98		
		130.95	Kerr and Russell Streets
		130.95	Chestnut Street
		130.95	Spring Street
<i>Downstream Boundary</i>	130.80	130.95	Long Street
Genoa Park & Amphitheatre <i>Upstream Boundary</i>	130.79		
		130.72	Broad Street
		130.71	Capital Street
		130.66	State Street
<i>Downstream Boundary</i>	130.51		

TABLE 4.3.49: (continued) Publicly Owned Areas with Immediate Access to Olentangy River and Scioto River			
Identified Sensitive Area	CSS River Mile Location	CSS River Mile Location	Impacting CSS Discharge(s)
Bicentennial Galbraith Park <i>Upstream Boundary</i>	130.51	130.47 130.40 130.40 130.40 130.40 130.40	Rich Street Cherry and Fourth Town and Fourth Mound and Grant Noble and Grant Noble and Fourth
<i>Downstream Boundary</i>	130.37		
Dodge Park <i>Upstream Boundary</i>	130.10	129.92	Dodge Park Combined PS
<i>Downstream Boundary</i>	129.89		
Whittier Street Parkland Addition <i>Upstream Boundary</i>	129.75		
<i>Downstream Boundary</i>	129.56		
Lower Scioto Park <i>Upstream Boundary</i>	129.56	128.69 128.69 128.69	I-71 east of Mound Street Liberty Street (Peters Run) Whittier Street Whittier Street Storm Standby Tanks
<i>Downstream Boundary</i>	128.61	128.78	
Lou Berliner Park and Southview Park <i>Upstream Boundary</i>	128.61	128.34 127.55	Moler Street Markison Avenue
<i>Downstream Boundary</i>	127.00		

**TABLE 4.3.50:
Designated Public Water Supplies**

Alum Creek			
Public Water Supply	Upstream River Mile	Downstream River Mile	Impacting CSS Discharge
No designated public water supplies are currently in the Upper Alum Creek, Lower Alum Creek and Three Rivers surface waters areas			
Big Walnut Creek			
Public Water Supply	Upstream River Mile	Downstream River Mile	Impacting CSS Discharge
No designated public water supplies are currently in the Three Rivers and Scioto-Big Walnut Confluence surface waters areas			
Olentangy River			
Public Water Supply	Upstream River Mile	Downstream River Mile	Impacting CSS Discharge
<i>Dublin Road WTP Emergency Water Intake</i>	0.3	0.2	All Lower Olentangy Surface Waters Area CSS discharges
Scioto River			
Public Water Supply	Upstream River Mile	Downstream River Mile	Impacting CSS Discharge
No designated public water supplies are currently in the Scioto-Downtown, Scioto-South Columbus, Scioto-Big Walnut Confluence and Scioto-Little Walnut Confluence surface waters areas			

TABLE 4.3.51: Special Freshwater Mussels Attributes of Receiving Waters		
Olentangy River		
Identified Species Attributes	Number of Living/ Fresh Dead	Impacting CSS Discharge(s)
Wilson Bridge Road Zone		
<i>Species of Concern</i> <i>Alasmidonta marginata</i> – Elktoe	3/0	None
<i>Lampsilis fasciola</i> - Wavy-rayed Lampmussel	0/1	
<i>Ptychobranhus fasciolaris</i> - Kidneyshell	2/1	
Dodridge Street Zone		
<i>Species of Concern</i> <i>Alasmidonta marginata</i> - Elktoe	2/0	None
Fifth Avenue Zone		
<i>Species of Concern</i> <i>Alasmidonta marginata</i> - Elktoe	4/1	Hudson Street, Doe Alley, Frambes Avenue, Indianola Avenue and Fifth Avenue CSOs
<i>Ptychobranhus fasciolaris</i> - Kidneyshell	0/1	
Scioto River		
Souder Avenue Zone		
No Special Species Sampled		
Greenlawn Avenue Zone		
<i>Species of Concern</i> <i>Anodonta suborbiculata</i> - Flat Floater	3/1	All CSS discharges except for the, Markison Avenue, Moler Street and Alum Creek CSOs
<i>Threatened Species</i> Fawnsfoot (<i>Truncilla donaciformis</i>)	1/1	
I 270 Zone		
<i>Species of Concern</i> <i>Truncilla truncata</i> - Deertoe	0/1	All CSS discharges except for the Alum Creek CSO
<i>Threatened Species</i> <i>Obliquaria reflexa</i> - Three-horn Wartyback	1/1	
<i>Truncilla donaciformis</i> - Fawnsfoot	1/1	

TABLE 4.3.51: (continued)		
Special Freshwater Mussels Attributes of Receiving Waters		
Scioto River (cont'd)		
Identified Species Attributes	Number of Living/ Fresh Dead	Impacting CSS Discharge(s)
State Route 762 Zone		
<i>Species of Concern</i>		All CSS discharges
<i>Alasmidonta marginata</i> - Elktoe	1/0	
<i>Truncilla truncata</i> - Deertoe	1/1	
<i>Threatened Species</i>		
<i>Truncilla donaciformis</i> - Fawnsfoot	7/7	

TABLE 4.3.52: Special Fish Attributes of Receiving Waters		
Olentangy River		
Identified Species Attributes	Number	Impacting CSS Discharge(s)
Wilson Bridge Road Zone		
<i>Species of Concern</i> River Redhorse	1	None
<i>Threatened Species</i> Bluebreasted Darter	1	
Dodridge Street Zone		
No Special Species Sampled		
Fifth Avenue Zone		
No Special Species Sampled		
Scioto River		
Greenlawn Avenue Zone		
<i>Species of Concern</i> River Redhorse	 1	All CSS discharges except for the Markison Avenue, Moler Street and Alum Creek CSOs
State Route 665 Zone		
<i>Threatened Species</i> Tippecanoe Darter	 1	All CSS discharges except for the Alum Creek CSO
Commercial Point Road Zone		
<i>Species of Concern</i> River Redhorse	9	All CSS discharges
Alum Creek		
Main Avenue Zone		
No Special Species Sampled		
Livingston Avenue Zone		
<i>Species of Concern</i> Muskellunge	1	Alum Creek CSO